Maternal Death REPORT

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MINISTRY OF HEALTH

Report on the

Confidential Enquiry into Maternal Deaths in Malawi

August 2020 – December 2022

Safe Motherhood

UNFPA

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Report on the Confidential Enquiry into Maternal Deaths in Malawi

August 2020 – December 2022

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FOREWORD

Malawi continues to experience unacceptably high levels of maternal mortality, with a recently estimated MMR (maternal mortality ratio) of 381 per 100,000 live births. Reductions in numbers of maternal deaths have plateaued, and currently it is unlikely that Malawi will meet sustainable development goal targets of reducing the MMR to less than 140 per 100,000 live births by the year 2030. This remains the case despite an impressive increase in facility-based birth to over 90% in recent years.

The National Committee for the Confidential Enquiry into Maternal Deaths (NCCEMD) was established in 2009 to produce regular reports aimed at understanding the problem of maternal mortality in Malawi, and to inform the selection of appropriate interventions to reduce maternal deaths. The first report covered the period 2008-12, and the second covered 2012-2014. Since then, the data collection system for gathering important information on maternal deaths has been strengthened through the creation of a digital reporting platform. Furthermore, the International Classification of Diseases, Tenth Revision including Maternal Mortality (ICD-10/MM) has been implemented in Malawi.

This document constitutes the third report on maternal death in Malawi, and covers the period 2020-2022. It was produced on behalf of the NCCEMD under the guidance of the Reproductive Health Directorate of the Ministry of Health of Malawi with technical assistance from the Malawi-Liverpool-Wellcome Clinical Research Programme (MLW). We acknowledge the contributions of all who were involved in the production of this report, detailed in the pages which follow. We have undertaken a comprehensive review and analysis of maternal deaths occurring in this period and our findings are intended to be used to guide policy and programming. Indeed, following the analysis process we convened a meeting of stakeholders and formulated a list of policy recommendations aimed at ending preventable maternal mortality in Malawi. These recommendations form a key component of this report.

It is our hope in producing this report that the information provided will become knowledge, that knowledge will become power, and power will be utilised to end preventable maternal mortality for the women of Malawi and their families. Nzeru ndi chuma.

CONTRIBUTORS & ACKNOWLEDGEMENTS

This report was commissioned by the Malawi National Committee for the Confidential Enquiry into Maternal Deaths (NCCEMD) on behalf of the Reproductive Health Directorate (RHD) of the Malawi Ministry of Health (MOH). Mrs Rosemary Bilesi was the lead from RHD, overseen by Dr Fannie Kachale, Director of RHD and Dr Owen Musopole. The Malawi-Liverpool-Wellcome (MLW) Clinical Research Programme Maternal and Fetal Health Research group provided technical expertise to produce the report, as well as facilitating digitalisation of data collection. Dr Jennifer Riches (MLW and University of Liverpool) was the lead writer and researcher for the report, with support in statistical analysis from Dr James Jafali (MLW and University of Liverpool), second review of causes of maternal death by Dr Yamikani Mbilizi (MLW and University of Liverpool), and research assistance from Dr Marthe Onrust. Dr Mitsunge Gondwe and Professor Linda Nyondo-Mipando assisted in the convening of stakeholder meetings to gather recommendations for inclusion in the report. All were supported by Professor David Lissauer (MLW and University of Liverpool).

This report relies on data available through a digital maternal health surveillance platform (MatSurvey), established in collaboration between the Malawi Ministry of Health and MLW Maternal and Fetal Health Research Group in 2020. We acknowledge the contribution of those who worked together to develop the MatSurvey surveillance platform (Appendix 10), those who maintain its operation, and those who collect, input, and validate data daily (Appendix 10).

We thank the wide range of stakeholders who gave feedback and input to this report including the NCCEMD, and those who met to provide recommendations for inclusion in the report (Appendix 10).

We acknowledge the generosity of the funders who have made this report possible. This research was funded by the NIHR through the Professorship of David Lissauer (funding both DL and JR) using UK aid from the UK Government to support global health research. The views expressed in this publication are those of the author(s) and not necessarily those of the NIHR or the UK government. Funding was also provided by The NIHR Safe Motherhood project, The Bill & Melinda Gates Foundation, The Wellcome Trust and The United Nations Population Fund (UNFPA). (see section 2.6 for details).

Maternal Death REPORT

EXECUTIVE SUMMARY

BACKGROUND

Malawi's maternal mortality ratio (MMR) was most recently estimated at 381 per 100,000 livebirths[1]. Although this represents a substantial decrease since the year 2000 when the MMR was 573 per 100,000[2], the annual decrease falls short of that necessary to achieve sustainable development goal (SDG) targets[3] and the MMR has plateaued in recent years. The National Committee for the Confidential Enquiry into Maternal Deaths (NCCEMD) was established to produce regular reports aimed at understanding the problem of maternal mortality in Malawi, and to inform the selection of appropriate interventions to reduce maternal deaths. Following the first report which covered the period 2008-12, and the second which covered 2012-2014, this document constitutes the third report of the committee and reports on maternal deaths occurring between 2020-2022.

METHODS

Routinely collected data from the clinical records of women who died in the peripartum period (during pregnancy or up to 42 days from the end of a pregnancy) was collected from the digital maternal health surveillance platform which captures data from 33 facilities across Malawi, and includes data from their surrounding primary healthcare facilities. Deaths were included if they occurred between 1st of August 2020 and December 31st 2022, and if they had been reviewed by a local maternal death review committee, and excluded if the death had been only reported, but not reviewed. Data was analysed and presented using descriptive statistics. Report authors reviewed the case narratives provided for each death and verified or reassigned cause of death as necessary. Findings were presented to a workshop of stakeholders representing all levels and cadres of the health system who proceeded to formulate a long list of policy recommendations which was later refined by NCCEMD members.

Maternal Death REPORT

EXECUTIVE SUMMARY

FINDINGS

A total of 1135 maternal deaths were reported in the period of this report; 809 were reviewed locally and therefore included in our analysis. In keeping with global causes of maternal death, and previous analyses of maternal deaths in Malawi, the leading causes of maternal death described in this report are maternal infection, postpartum haemorrhage, and eclampsia. Facility-based birth rates have increased dramatically in recent years, with over 90% of women now delivering their babies in health facilities. However, our analysis determines that "healthcare worker" factors are associated with over 80% of maternal deaths. The reasons for this are likely to be complicated and multifaceted but demand our efforts in understanding them if maternal mortality in Malawi is to be reduced further. Simply getting to the facility is not enough; quality of care must be improved by providing healthcare workers with the resources, skills, and motivation to provide high quality obstetric care. A summary of key findings is found in the following pages.

CONCLUSION & RECOMMENDATIONS

Recommendations based on the findings of this report were formulated by stakeholders from all levels of the health system and partner organisations. They are intended to be used by policy makers, implementors and funding organisations to effectively reduce maternal mortality in Malawi. They address the need to improve the referral and admissions process, reduce deaths following Caesarean section, tackle the leading causes of maternal death, address healthcare worker factors associated with maternal deaths and improve health-seeking behaviour at the community level. A summary of key recommendations is found in the following pages.

Maternal Death REPORT

SUMMARY OF KEY FINDINGS

From August 2020 to December 2022, Malawi recorded a total of 1,135 deaths. Out of these deaths, 71.3% were reviewed by an MDSR (Maternal Death Surveillance and Response) committee and had a complete MDA-2 (Maternal Death Audit-2) form, making them eligible for further analysis. Table 1 provides the numbers of deaths, the percentage of deaths reviewed, and the Maternal Mortality Ratio (MMR) for each district and central hospital.

1,135 DEATHS REPORTED

71.3%

REPORTED DEATHS WERE REVIEWED BY AN MDSR COMMITTEE

809 DEATHS REVIEWED

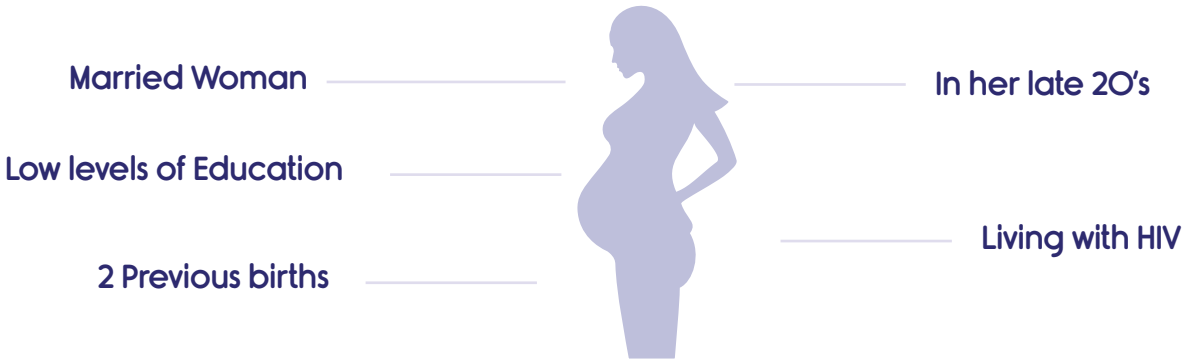
MATERNAL INFECTION (24.8%)

POSTPARTUM HAEMORRHAGE (20.4%)

ECLAMPSIA (13.3%)

The contribution of infections directly related to pregnancy has remained stable since 2008 at around 9-10% of all deaths, suggesting a need for a change in strategy to tackle this cause of death.

The typical demographic profile of a woman dying in the peripartum period

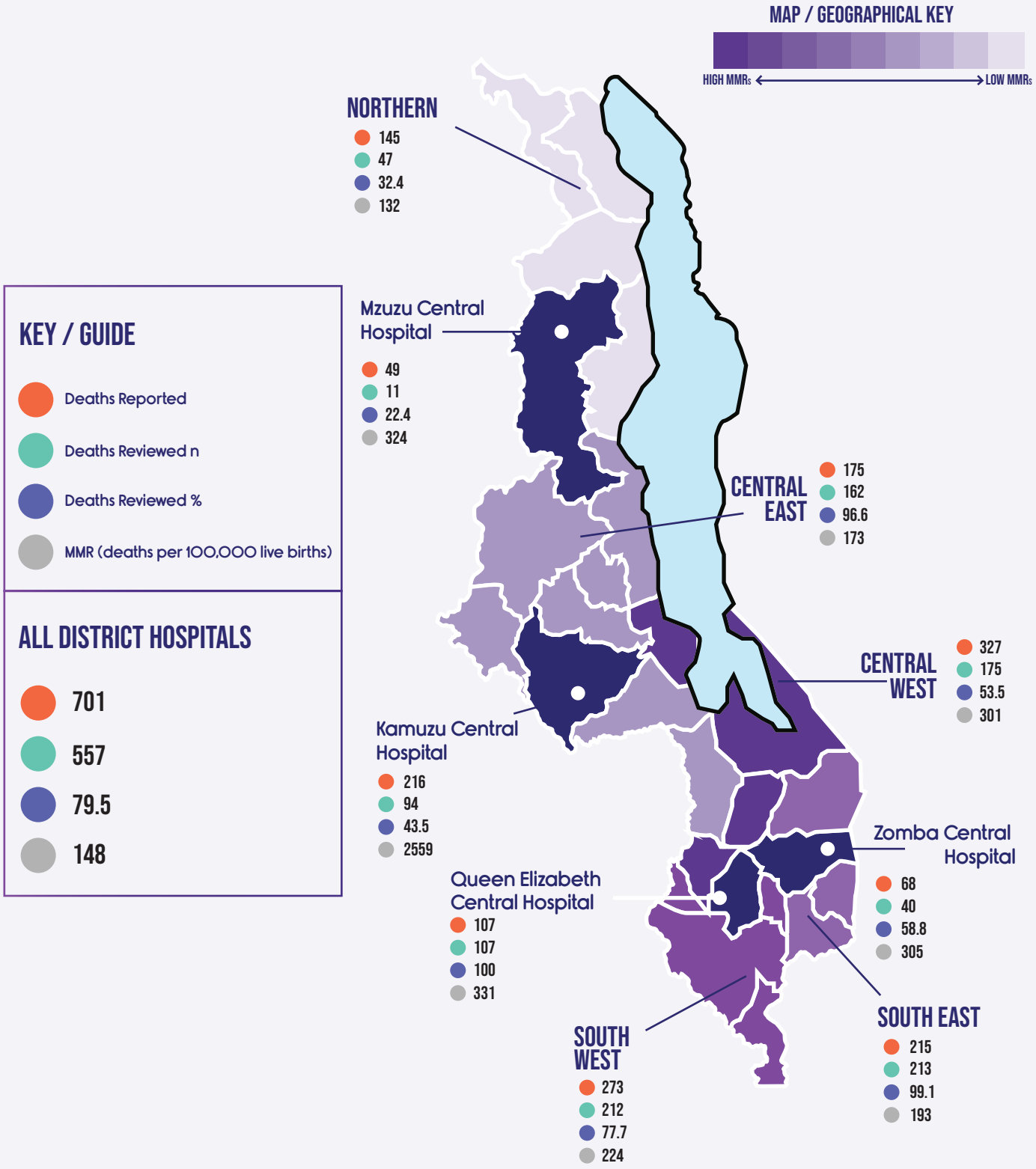


The median age of women who died was 27 years, perhaps older than many key stakeholders would have expected.

Maternal Death REPORT

SUMMARY OF KEY FINDINGS

Geographical Distribution of Maternal Deaths in Malawi 2020-22



Maternal Death REPORT

SUMMARY OF KEY FINDINGS

EARLY PREGNANCY

There was evidence of unsafe induced abortion in 27% of abortion-related deaths. However, it is possible that induced abortions are underrepresented in our data set due to cultural, religious and legal barriers to seeking care following induced abortion or disclosing when an abortion has been induced. Of women who died in early pregnancy, 35.1% died of infection (septic miscarriage).

ANTENATAL CARE

Most women who died had accessed antenatal care during their pregnancy, with an average of 3 visits per woman who died. Danger signs were detected during antenatal care for 21.6% of women
who died. However, 23.7% of these had no action taken on danger signs detected.

TIMING OF DEATH

Most deaths occurred at term (37 weeks gestation). Maternal deaths were highest in the postnatal period (64.9%), particularly within 24 hours after birth (36%). Late postnatal deaths were more common in central hospitals, possibly indicating complex cases referred for specialist care. Infections caused most deaths in the late postnatal period (53%), while postpartum hemorrhage deaths were more frequent in the early postnatal period (80%). Eclampsia deaths were distributed across the antenatal (29.6%), early postnatal (31.5%), and late postnatal (28.7%) periods.

WHERE WOMEN CAME FROM AND CONDITION ON ARRIVAL

Around 60% of women were referred from another facility to the facility where they died. This was the case for all three leading causes of death. Most women arrived at the facility where they died in a critically ill condition (54.5%), and this was the case across all zones. However, a large number arrived in stable condition (37.6%). Women dying of infection and eclampsia were more likely to arrive in critically ill condition (73.1% and 64.8%). Women dying of PPH were likely to be stable on arrival (60.0%).

GIVING BIRTH

Over 50% of deaths occurred after Caesarean section (CS), but CS may not be the cause. Further investigation is needed. Among CS deaths, 24% were due to postpartum hemorrhage (PPH), 15% to eclampsia, and 14% to pregnancy-related infections. Vacuum births were more common in PPH deaths, indicating a need for better training and supervision. Around 30% of PPH deaths involved retained placenta, suggesting a need for improved management of third-stage labor complications.

AVOIDABLE FACTORS

"Healthcare worker" factors were the leading avoidable causes of maternal deaths in Malawi, accounting for 85% of all deaths. These factors included inadequate monitoring, prolonged abnormal observations without action, and a lack of obstetric emergency skills. More than half of the deaths involved "administrative factors," such as resource shortages, transportation issues, and communication problems, which could have been prevented. "Patient/family factors" also contributed to over half of the deaths, with delays in reporting to a healthcare facility being the most common factor. This delay was particularly notable in deaths caused by maternal infection but was prevalent across all causes of death.

Maternal Death REPORT

SUMMARY OF KEY RECOMMENDATIONS

Key stakeholders agreed recommendations based on the findings of this report. For full detail please refer to Section 6.0.

1. **To improve the referral and admission processes:**
   a. **Develop standardised referral guidelines** with criteria for referral between different levels of care.
   b. **Develop and implement a pre-transfer checklist** for all patients being referred.
   c. **Develop and implement a standardised admission assessment form** (specific to each level of health system)
   d. **Establish an obstetric critical care pathway and improve intensive care capacity** at secondary and tertiary hospitals.

2. **To reduce deaths following Caesarean section:**
   a. **Ensure and enforce the use of a surgical safety checklist specific to Caesarean section** across all facilities nationwide.
   b. **Adopt and implement a national policy of vaginal cleansing prior to skin incision at every Caesarean section** to reduce infection.
   c. **Develop and implement an inpatient postnatal care record/pathway** to improve the monitoring of post-operative obstetric patients whilst on the wards and ensure action on abnormal vital signs and examination findings.
   d. **Improve the quality of CS surgery** by improving training of clinical officers and medical students through establishing certified training centres and competency-based sign-off.
   e. **Improve resource availability for safe CS surgery** by ensuring adequate supply of antiseptics, linen, drugs (particularly tranexamic acid, oxytocin, IV fluids, antibiotics) and blood products.

3. **To reduce deaths from infection:**
   a. **Provide education to pregnant women and their communities** about the risks of infection and how to prevent and recognise infection (during antenatal care, on labour ward, and during postnatal care)
   b. **Strengthen infection prevention and control practices** amongst healthcare workers.
   c. **Improve availability of antibiotics**, particularly newer generations.

4. **To reduce deaths from PPH:**
   a. **Engage with communities to discourage harmful traditional practices** including use of local Pitocin.
   b. **Improve early detection and treatment of anaemia** through increased availability of full blood count testing and haematinics and improved community awareness of diet to prevent anaemia in pregnancy.

SUMMARY OF KEY RECOMMENDATIONS

c. **Add tranexamic acid to essential drugs list** and ensure adequate supply and train staff in its use to prevent and manage bleeding.
d. **Improve skills in management of delivery of placenta and membranes including management of retained placenta.**

5. **To reduce deaths from eclampsia:**
   a. **Improve detection of hypertension and proteinuria** antenatally by increasing the availability of functioning blood pressure machines and urine dipsticks.
   b. **Improve management of antenatal hypertension** by ensuring availability of medications and treatment protocols (particularly for mild/moderate hypertension to prevent disease progression and complications).
   c. **Ensure constant supply of good quality first and second line antihypertensives** at all levels of the health care system.
   d. **Improve supply of treatment for acute severe hypertension/pre-eclampsia including magnesium sulphate and anti-hypertensives.**

6. **To address healthcare work factors associated with maternal death:**
   a. **Improve supervision and mentorship of healthcare workers** by ensuring robust supervision and reducing off site training for management level healthcare workers.
   b. **Improve performance of healthcare workers** by auditing practice and carrying out quarterly skills drills in the management of obstetric emergencies (run in alignment with existing Quality Improvement projects).
   c. **Improve working conditions and motivation of HCWs** by ensuring adequate supply of resources for optimal patient care, renumerating fairly/increasing pay, and reinforcing non-monetary rewards.

7. **To improve health-seeking behaviour at community level:**
   a. **Translate into lay language, and share data from this report** with community leaders.
   b. **Encourage male involvement in antenatal care** by making the first antenatal contact meaningful for men.
   c. **Encourage families to have birth preparedness plans** that include emergency scenarios.
   d. **Strengthen antenatal care to provide more information about danger signs** and how and when to seek help.
   e. **Develop a feedback mechanism for service users** (e.g. an anonymous phone line).

ABBREVIATIONS & ACRONYMS

ANC	Antenatal Care
ARV	Anti-Retroviral
CS	Caesarean Section
FCDO	UK Foreign and Commonwealth Development Office
GIZ	German Agency for International Cooperation
HIV	Human Immunodeficiency Virus
ICD-10/MM	International Classification of Diseases, Tenth Revision, Maternal Mortality
KCH	Kamuzu Central Hospital
MDA-1	Maternal Death Audit-1
MDA-2	Maternal Death Audit-2
MDSR	Maternal Death Surveillance and Response
MLW	Malawi-Liverpool-Wellcome Research Programme
MMR	Maternal Mortality Ratio
MOH	Ministry of Health
NCCEMD	National Committee on the Confidential Enquiry into Maternal Deaths
NIHR	National Institute for Health and Care Research (UK)
OR	Odds Ratio
PPH	Postpartum Haemorrhage
QECH	Queen Elizabeth Central Hospital
RHD	Reproductive Health Directorate
SDG	Sustainable Development Goal
TBA	Traditional Birth Attendant
UNFPA	United National Population Fund
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organisation

01.
Introduction & Background

INTRODUCTION & BACKGROUND

Malawi's maternal mortality ratio (MMR) was most recently estimated at 381 per 100,000 livebirths[1]. Although this represents a substantial decrease since the year 2000 when the MMR was 573 per 100,000[2], the annual decrease falls short of that necessary to achieve the sustainable development goal (SDG) target of an MMR of <140 per 100,000 live births by 2030[3]. In Malawi, a woman's lifetime risk of dying in pregnancy, during childbirth or immediately following pregnancy is 1 in 60[1].

In recent years, Malawi has made great progress in the uptake of facility-based birth. The percentage of women giving birth with the assistance of a skilled birth attendant increased to over 96% by2021[4]. Emphasis has been placed on quality of care. However, these improvements have not translated to a dramatic decrease in maternal mortality, and therefore there is a need to explore not only the medical causes of maternal death in Malawi, but also the health system factors involved in those deaths. It is our hope that this report will provide further information to this effect.

In response to its high maternal mortality ratio, Malawi instituted the National Committee on the Confidential Enquiry into Maternal Deaths (NCCEMD) in 2009. Maternal death reporting became mandatory and maternal death review by local maternal death surveillance and response (MDSR) committees commenced. The first report on maternal deaths was commissioned by the NCCEMD and comprised of an analysis of deaths occurring between 2008-2012. Following this, a further report covering the period 2012-2014 was published. Since then, the International Classification of Diseases, Tenth Revision including Maternal Mortality (ICD-10/MM)[5] has been implemented in Malawi and reporting and review procedures have been strengthened using an online digital reporting platform (MatSurvey http://www.matsurv.org[6]) displaying surveillance information to facilities and zones, in real time. It is in this context that we present this analysis of maternal deaths over the period 2020-2022.

02. Methods

2.1 DATA COLLECTION

This report uses data routinely collected using two forms established by the MOH and completed locally by MOH staff at facility level, with the district-based safe motherhood coordinator having primary responsibility for this task. The first is the Maternal Death Audit-1 (MDA-1) form, which serves as an initial notification of the maternal death, with some basic details, which should be completed within the first 24 hours of the death. The second is the Maternal Death Audit-2 (MDA-2) form, a tool completed at the time the death is reviewed in detail at the facility, ideally within 7 days in order that memory of events and clinical notes are accessible. Since mid-2020, the reporting system has been digitalised with MDA-1 and MDA-2 forms now completed on a tablet held by the facility and uploaded to a digital surveillance platform (MatSurvey) hosted by the Malawi-Liverpool-Wellcome (MLW) Clinical Research Programme. To ensure the reliability of uploaded data and to limit inconsistencies in data entry, validation rules were included (skip-logics and cross-validation against a second entry).

MatSurvey was established in partnership between the MOH and MLW during the Covid-19 pandemic, with the aim of improving maternal death and near miss surveillance, and in line with World Health Organisation (WHO) strategies toward ending preventable maternal mortality using information technology[7]. Data for analysis were extracted exclusively from the MDA-1 and MDA-2 forms held on the MatSurvey platform. Data from MDA-1 forms were used to determine numbers of maternal deaths at national, zonal and facility level. Data from MDA-2 forms were used to conduct all further analyses.

2.2 INCLUSION CRITERIA

Maternal deaths with a completed MDA-2 form are included in the analysis presented in this report. Women whose death was reported using an MDA-1 but who did not have an MDA-2 form completed were included in estimates of numbers of maternal deaths but were not included in further analyses.

This report includes maternal deaths occurring between 1st August 2020 and 31st December 2022. Data were included from 33 healthcare facilities across all regions of Malawi including all four central hospitals and all 27 district hospitals. Deaths occurring outside of these facilities (e.g. in primary health care facilities or in the community) are commonly reported by the corresponding district hospital, and therefore included in our analysis. A full list of district and central hospitals corresponding to each regional zone of Malawi is listed in Appendix 1.

Efforts were made by RHD and the MLW MatSurvey team to encourage timely and complete reporting of data through the MatSurvey platform. This included training of all safe motherhood coordinators, telephone contact and in-person visits where feasible.

2.3
CLASSIFICATION OF MATERNAL DEATHS

Malawi has a classification system for determining groups and causes of maternal deaths, based on WHO ICD-10/MM (2012) categories (see Appendix 6). Local maternal death surveillance and response (MDSR) committees at facility level determined the cause of each maternal death as part of their review of the death using an MDA-2 form. However, it should be noted that the MDA-1 and MDA-2 forms used to collect data do not specify that cause of death should be linked to this classification system. From December 2021, a requirement to select from the list of causes of death outlined in this system became a requirement of data entry to the MatSurvey platform.

Following determination of cause of death by the local MDSR committee, the deaths were reviewed by obstetric specialist report authors for accuracy of attribution of cause. The cause of death was defined using WHO principles as "the disease or condition that initiated the morbid chain of events leading to the death"[5]. Where there were discrepancies, a second obstetric specialist opinion was sought.

This report represents the first comprehensive use of the agreed classification system at a national level, and as such some minor adjustments have been made to ensure it aligned with the previous Malawian national classification approach and is consistent with updated WHO definitions (see Appendix 2 for full classification table used in this report). For example, the updated definition of maternal sepsis as "a life-threatening condition defined as organ dysfunction resulting from infection during pregnancy, childbirth, post-abortion, or postpartum period"[8] has been applied to cases included in this report. As such we have combined all infections into one group, "maternal infection" for presentation in the main report and inclusion in analyses

A small number of other simplifications were made to improve clarity of the results reported. "Neoplasms" and "Cancer" were combined under "Cancer". "Peripartum cardiomyopathy" was included under "Other Obstetric Complications" and "Septic miscarriage" was added to the "Abortion/Miscarriage" group.

MDSR committees linked "associated factors" which each maternal death. Associated factors are summarised in four pre-determined categories and their subcategories from which the review committee can select factors that they feel may have been preventable in the sequence of events leading to the woman's death. During this process it was possible for the committee to select each category and subcategory once, more than once or not at all.

2.4
DATA ANALYSIS

Categorical variables were summarised using frequencies and proportions, and continuous variables using medians and interquartile ranges. Between-group analyses were conducted using Chi-square tests for categorical variables and Wilcoxon Rank Sum test for non-normal continuous variables. Further, we applied logistic regression analysis to estimate the odds (and 95% confidence intervals) associated with dying of leading causes of maternal death compared with other causes of maternal death. Significance was determined at p value of less than 0.05. Analyses were performed using R version 4·2·3 (21-03-2023). A code book for the analysis outlined in this report is available upon request to the authors for clarification of findings and for the compilation of future reports.

Section 4.0 includes technical briefs on each leading cause of death and anonymised summaries of case narratives recorded on MDA-2 forms. The purpose of these briefs is to highlight specific findings around each cause of death for potential policy interventions. We anticipate that these will be used as part of a separate, shorter policy briefing document that can be circulated to stakeholders with key messages and recommendations from this report.

2.5
STAKEHOLDER ENGAGEMENT

The planned analysis and scope of the report was agreed by the NCCEMD at the outset. Later, feedback was provided on drafts and recommendations for inclusion were formulated through consultation with key stakeholders including representatives from the Quality Management Directorate, the Nursing and Midwifery Directorate, the Association of Obstetricians & Gynaecologists of Malawi, the Association of Midwives of Malawi, The Association of Obstetric Clinical Officers of Malawi, and The Association of Anaesthetists of Malawi, the Heads of Department of all four Central Hospitals and a representative from Kamuzu University of Health Sciences School of Midwifery and Neonatology. Partner organisations contributing to feedback on drafts and formulation of recommendations included representation from WHO, UNFPA, The United Nations Children's Fund (UNICEF), Momentum (United States Agency for International Development, USAID) and the German Agency for International Cooperation (GIZ), MLW Maternal and Fetal Health Group, The UK Foreign and Commonwealth Development Office (FCDO), The NIHR SafeMotherhood Group, and The White Ribbon Alliance for Safe Motherhood.

2.6 FORMULATING RECOMMENDATIONS

We convened a workshop of key stakeholders (outlined above) with the aim of producing a list of key recommendations for action for reducing maternal deaths based on the findings of this report. Representatives from all levels of the health system and all disciplines involved in maternity care in Malawi were in attendance (Appendix 10). The results of the report were presented to stakeholders who then developed a long list of recommendations. A description of this process is included in Appendix 11.

The findings of the report and long list of recommendations was then presented to the NCCEMD who added further suggestions and grouped the long list into theme areas. The committee then delegated responsibility to a small working group to summarise recommendations made within each theme, developing a final, shorter list of key recommendations to take forward in policy and advocacy work with government and partners.

2.7 FUNDING

Funding for the MatSurvey platform and the production of this report came from the National Institute for Health & Care Research (NIHR) UK (Professorship of David Lissauer NIHR 300808 and Safe Motherhood Global Health Research Group NIHR 134781) using UK aid from the UK Government to support global health research, The Bill & Melinda Gates Foundation (BMG618), the Wellcome Trust, and the United Nations Population Fund. The views expressed in this report do not represent views of the above-mentioned funders

03. Findings

3.1 NUMBER OF DEATHS REPORTED AND REVIEWED

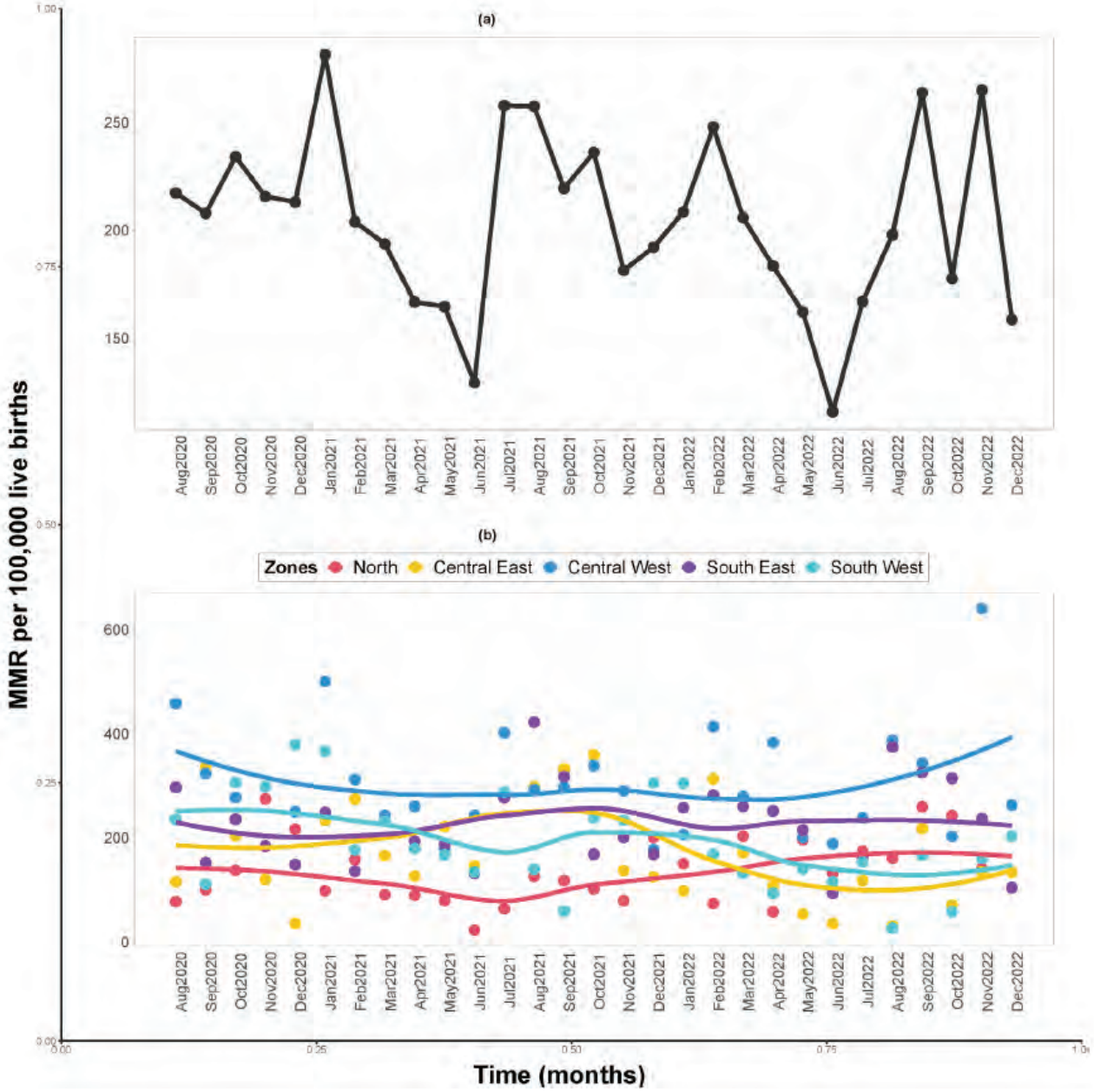
1135 deaths were reported across Malawi in this period. Of these, 71.3% were reviewed by an MDSR committee and had a complete MDA-2 form and were therefore included in further analyses. Numbers of deaths with the percentage reviewed and MMR for each district and central hospital are presented in Table 1. Figure 1 depicts change in MMR over the period of the report, zonally and nationally. Live births for use in maternal mortality ratio calculations were taken from facility-level data and may not include all births occurring in the zone below district hospital level.

Table 1. Geographical Distribution of Maternal Deaths in Malawi 2020-22

Geographic Area	Deaths Reported	Deaths Reviewed n	Deaths Reviewed %	MMR (deaths per 100,000 live births)
National	1135	809	71.3	-
Zone				
Central East	175	162	92.6	173
Central West	327	175	53.5	301
Northern	145	47	32.4	132
South East	273	212	77.7	224
South West	215	213	99.1	193
Central Hospital				
Mzuzu Central Hospital	49	11	22.4	323
Kamuzu Central Hospital	216	94	43.5	2559
Zomba Central Hospital	68	40	58.8	305
Queen Elizabeth Central Hospital	107	107	100	331
District Hospital				
All district hospitals	701	557	79.5%	148

MMR = Maternal Mortality Ratio (deaths per 100,000 live births)

Figure 1. Change in maternal mortality over time: a) Malawi b) Zonal regions



3.2 DEMOGRAPHIC CHARACTERISTICS & OBSTETRIC HISTORY OF WOMEN WHO DIED

Demographic characteristics for women who died are shown in Table 2. Parity of women who died is shown in Table 3.

Table 2. Demographic Characteristics of women who died

Variable	Total (n=809) n (%)	North (n=47) n (%)	Central East (n=162) n (%)	Central West (n=175) n (%)	South East (n=212) n (%)	South West (n=213) n (%)	p value[a]
Age groups							
<20 yrs	134 (16.65%)	9 (19.1%)	29 (17.9%)	27 (15.4%)	35 (16.5%)	34 (16.0%)	0.411
20-25 yrs	233 (28.8%)	13 (27.7%)	43 (26.5%)	62 (35.4%)	65 (30.7%)	50 (23.5%)	
26-35 yrs	268 (33.1%)	19 (40.4%)	49 (30.2%)	53 (30.3%)	67 (31.6%)	80 (37.6%)	
>35 yrs	174 (21.5%)	6 (12.8%)	41 (25.3%)	33 (18.9%)	45 (21.2%)	49 (23.0%)	
Missing	0	0	0	0	0	0	
Marital Status							
Married	636 (88.7%)	41 (91.1%)	133 (89.9%)	134 (87.0%)	157 (87.7%)	171 (89.5%)	0.435
Single	65 (9.1%)	4 (8.9%)	14 (9.5%)	15 (9.7%)	17 (9.5%)	15 (7.9%)	
Other	16 (2.2%)	0 (0.0%)	1 (0.7%)	5 (3.2%)	5 (2.8%)	5 (2.6%)	
Missing	92	2	14	21	33	22	
Educational Level							
None	225 (32.1%)	13 (30.2%)	45 (31.0%)	33 (22.1%)	67 (37.4%)	67 (36.4%)	**<0.001**
Primary	339 (48.4%)	21 (48.8%)	84 (57.9%)	80 (53.7%)	87 (48.6%)	67 (36.4%)	
Secondary	111 (15.9%)	6 (14.0%)	14 (9.7%)	28 (18.8%)	21 (11.7%)	42 (22.8%)	
Tertiary	25 (3.6%)	3 (7.0%)	2 (1.4%)	8 (5.4%)	4 (2.2%)	8 (4.3%)	
Missing	109	4	17	26	33	29	
HIV Status							
Negative	543 (88.1%)	37 (97.4%)	118 (95.2%)	105 (89.7%)	145 (87.3%)	138 (80.7%)	**0.001**
Positive	73 (11.9%)	1 (2.6%)	6 (4.8%)	12 (10.3%)	21 (12.7%)	33 (19.3%)	
Missing	193	9	38	58	46	42	
HIV+ taking ARVs							
Not taking ARVs	31 (42.5%)	1 (100.0%)	3 (50.0%)	9 (75.0%)	8 (38.1%)	10 (30.3%)	0.065
Taking ARVs	42 (57.5%)	0 (0.0%)	3 (50.0%)	3 (25.0%)	13 (61.9%)	23 (69.7%)	

[a] P value for determining significance in differences in distributions of variables between zones

3.2.1 AGE

The ages of women who died ranged from 14 years to 50 years of age, with an average (median) age of 27 years (IQR 21.5-33.6yrs). The age category contributing the highest proportion of maternal deaths was the group 26-35 years, with 268 women in this category (33.1%). There was no statistically significant difference in the ages of women who died between the five zones of Malawi (Table 1).

3.2.2 MARITAL STATUS AND EDUCATIONAL LEVEL

The majority of women who died were married (n=636 [88.7%]) and had either no education (n=225, [32.1%]) or had only primary-level education (n=339, [48.4%]) (Table 1).

3.2.3 HIV STATUS

The majority of women who died were not living with HIV prior to their death (n=453, [88.1%]) (Table 1). Of the 73 women living with HIV, 42 (57.5%) were taking anti-retroviral treatment (ART)

3.2.4 PARITY

The parity of women who died ranged from 0 to 10 births. The average (median) parity was 2 previous births (IQR 1.0, 4.0). Women with ≥4 previous births constituted the largest proportion (n=165, [28.4%]) of maternal deaths (Table 3). There was no significant difference in the parity of women who died between the zones of Malawi (Table 3).

Table 3. Parity of women who died

Variable	Total (n=809) n (%)	North (n=47) n (%)	Central East (n=162) n (%)	Central West (n=175) n (%)	South East (n=212) n (%)	South West (n=213) n (%)	p value
Parity							
0	73 (12.5%)	8 (21.6%)	16 (12.7%)	8 (9.9%)	22 (13.5%)	19 (10.9%)	0.627
1	141 (24.2%)	4 (10.8%)	29 (23.0%)	26 (32.1%)	41 (25.2%)	41 (23.4%)	
2	107 (18.4%)	7 (18.9%)	24 (19.0%)	13 (16.0%)	27 (16.6%)	36 (20.6%)	
3	96 (16.5%)	8 (21.6%)	16 (12.7%)	16 (19.8%)	26 (16.0%)	30 (17.1%)	
≥4	165 (28.4%)	10 (27.0%)	41 (32.5%)	18 (22.2%)	47 (28.8%)	49 (28.0%)	
Missing	227	10	36	94	49	38	

3.3
ANTENATAL CARE OF WOMEN WHO DIED

The majority of women who died received antenatal care (n= 564, [83.3%]) (ANC), ranging from 0 visits to a maximum of 9 visits per woman (Table 4). The median number of ANC visits for women who died was 3.0 (IQR 2.0, 4.0), with no significant difference between zones in the median number of ANC visits. However, the overall distribution of antenatal visits was different between zones.

Table 4. Number of antenatal visits and identification of danger signs for women who died

Variable	Total (n=809) n (%)	North (n=47) n (%)	Central East (n=162) n (%)	Central West (n=175) n (%)	South East (n=212) n (%)	South West (n=213) n (%)	p value
ANC visits							
0	1 (0.2%)	0 (0.0%)	0 (0.0%)	1 (0.9%)	0 (0.0%)	0 (0.0%)	**0.007**
1	59 (10.7%)	2 (6.1%)	8 (6.6%)	20 (18.7%)	16 (10.9%)	13 (9.1%)	
2	100 (18.1%)	5 (15.2%)	28 (23.1%)	17 (15.9%)	23 (15.6%)	27 (18.9%)	
3	153 (27.8%)	8 (24.2%)	24 (19.8%)	33 (30.8%)	38 (25.9%)	50 (35.0%)	
4	122 (22.1%)	7 (21.2%)	25 (20.7%)	18 (16.8%)	44 (29.9%)	28 (19.6%)	
5	74 (13.4%)	6 (18.2%)	26 (21.5%)	7 (6.5%)	17 (11.6%)	18 (12.6%)	
>5	42 (7.6%)	5 (15.2%)	10 (8.3%)	11 (10.3%)	9 (6.1%)	7 (4.9%)	
Missing	258	14	41	68	65	70	
4 visits							
<4	313 (56.8%)	15 (45.5%)	60 (49.6%)	71 (66.4%)	77 (52.4%)	90 (62.9%)	0.020
≥4	238 (43.2%)	18 (54.5%)	61 (50.4%)	36 (33.6%)	70 (47.6%)	53 (37.1%)	
Missing	258	14	41	68	65	70	
Danger signs							
No	415 (78.4%)	30 (90.9%)	83 (70.3%)	74 (76.3%)	119 (80.4%)	109 (82.0%)	0.056
Yes	114 (21.6%)	3 (9.1%)	35 (29.7%)	23 (23.7%)	29 (19.6%)	24 (18.0%)	
Action taken							
No	27 (23.7%)	0 (0.0%)	9 (25.7%)	6 (26.1%)	9 (31.0%)	3 (12.5%)	0.461
Yes	87 (76.3%)	3 (100.0%)	26 (74.3%)	17 (73.9%)	20 (69.0%)	21 (87.5%)	

For women receiving antenatal care, 529 (93.8%) had available information regarding whether danger signs were documented during their antenatal visits. Of these 529 women, 114 had danger signs identified (21.6%); 87 (76.3%) of whom had action taken in relation to danger signs.

3.4 ADMISSION DETAILS OF WOMEN WHO DIED

Most women who died were admitted from another facility (n=472, [59.45%]) rather than from home/community (n=322, [40.6%]), and arrived in critically ill condition (n=441, [55.5%]). The location women were admitted from and their condition on arrival at the facility where they died is shown in Table 5.

Table 5. Origin of women who died and condition on admission at facility where they died

Variable	Total (n=809) n (%)	North (n=47) n (%)	Central East (n=162) n (%)	Central West (n=166) n (%)	South East (n=209) n (%)	South West (n=210) n (%)	p value
Location admitted from							
Another facility	472 (59.4%)	21 (44.7%)	77 (47.5%)	116 (69.9%)	123 (58.9%)	135 (64.3%)	**<0.001**
Community	322 (40.6%)	26 (55.3%)	85 (52.5%)	50 (30.1%)	86 (41.1%)	75 (35.75)	
Condition on admission							
Stable	304 (38.3%)	17 (36.2%)	59 (36.4%)	54 (32.5%)	92 (44.0%)	82 (39.0%)	<0.001
Critically ill	441 (55.5%)	28 (59.6%)	84 (51.9%)	110 (66.3%)	100 (47.8%)	119 (56.7%)	
Dead on arrival	49 (6.2%)	2 (4.3%)	19 (11.7%)	2 (1.2%)	17 (8.1%)	9 (4.3%)	
Missing	15	0	0	9	3	3	

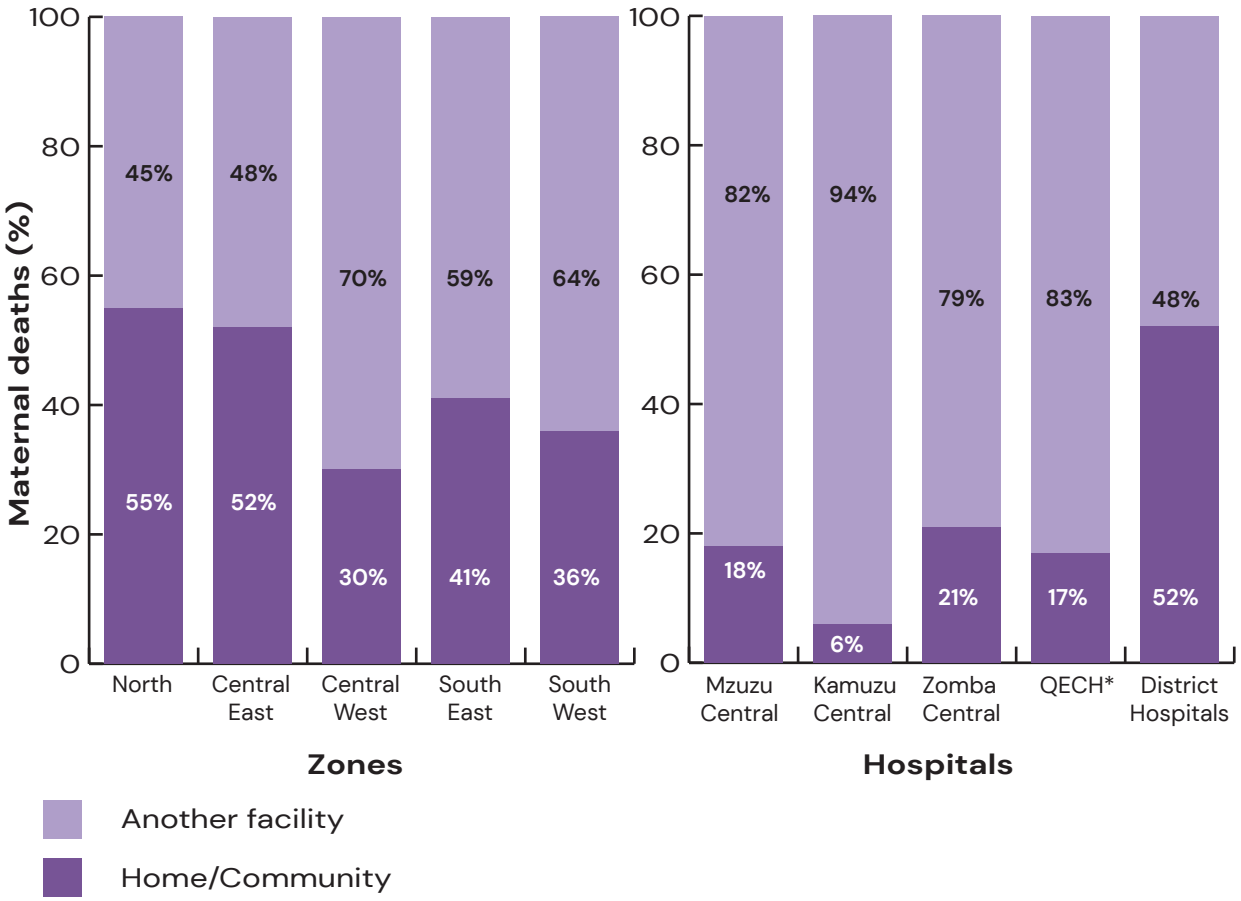
3.4.1 LOCATION WOMEN WERE ADMITTED FROM

There was a significant difference between the zones in both the location where women were admitted from and their condition on arrival at the facility where they died (Table 5). However, most women in every zone were admitted in critically ill condition. The location women were admitted from across all zones, central hospitals and district hospitals is shown in Figure 2. The North and Central East had higher proportions arriving from home than from another facility. The Central West, South East and South West had a higher proportion of women dying after referral from another facility when compared to the national average (Table 5, Figure 2). Central hospitals had a higher proportion of women arriving from other facilities compared to district hospitals, ranging from 79% at Zomba Central Hospital to 94% at Kamuzu Central Hospital (Figure 2).

3.4.2 CONDITION ON ARRIVAL AT FACILITY

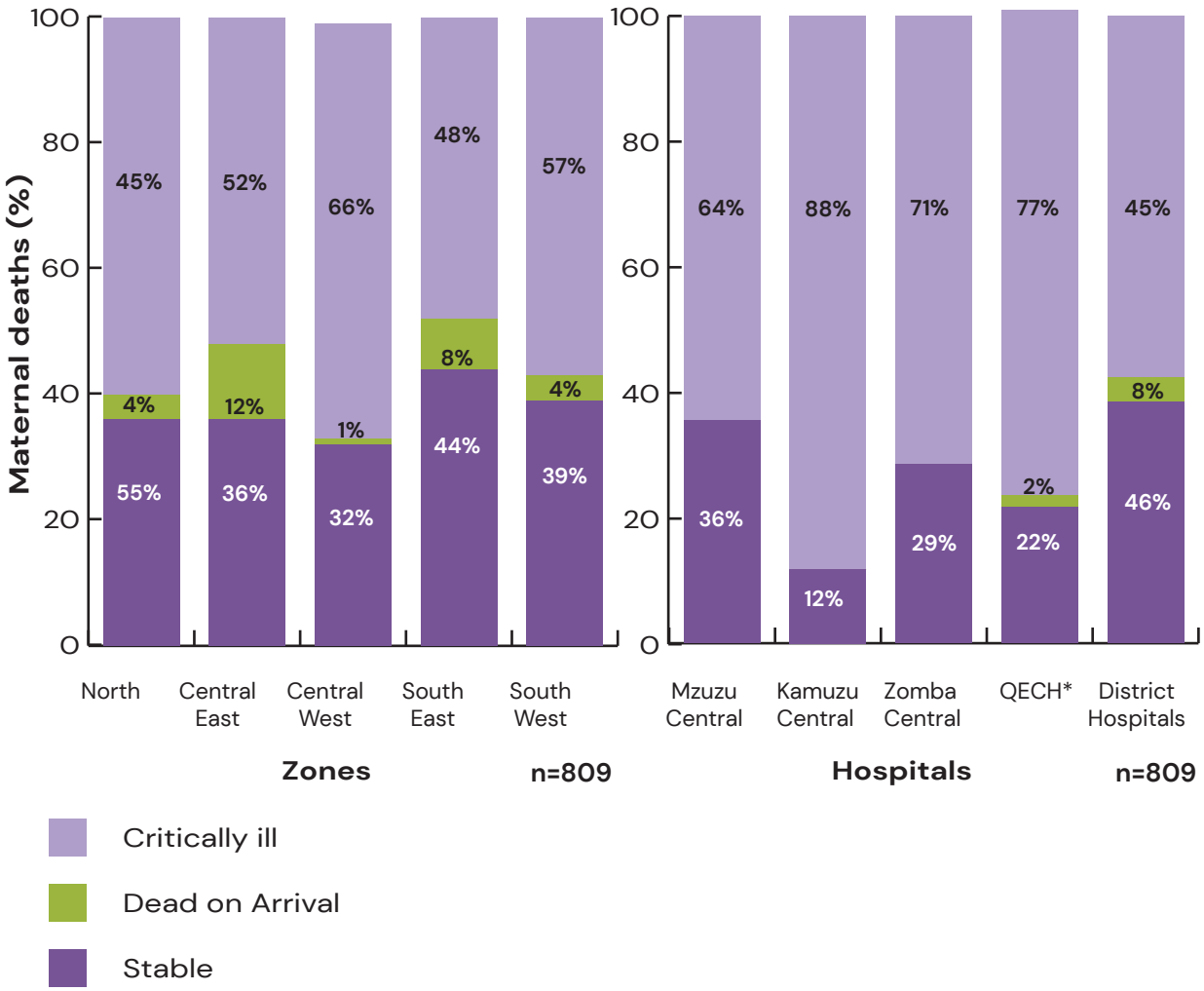
Figure 3 shows the condition of women arriving to the facility where they died at zonal, central and district hospital level. The North, Central West and South West had a higher proportion of women dying after arrival in critical condition when compared to the national average (Table 5, Figure 3). All central hospitals had a higher proportion of women dying after arrival in a critical condition compared to other facilities, ranging from 64% at Mzuzu Central Hospital to 88% at Kamuzu Central Hospital.

Figure 2. Location women were admitted from prior to death by zone and facility



QECH = Queen Elizabeth Central Hospital

Figure 3. Condition on arrival at facility



QECH = Queen Elizabeth Central Hospital

3.5
DELIVERY INFORMATION FOR WOMEN WHO DIED

Delivery information for women who died is given in Table 6.

Table 6. Delivery information for women who died

Variable	Total (n=809) n (%)	North (n=47) n (%)	Central East (n=162) n (%)	Central West (n=175) n (%)	South East (n=212) n (%)	South West (n=213) n (%)	p value
Gestation							
<28	119 (17.1%)	9 (20.9%)	31 (20.9%)	22 (17.1%)	31 (15.7%)	26 (14.8%)	0.280
28-31	78 (11.2%)	4 (9.3%)	8 (5.4%)	19 (14.7%)	23 (11.6%)	24 (13.6%)	
32-36	219 (31.6%)	10 (23.3%)	49 (33.1%)	47 (36.4%)	56 (28.3%)	57 (32.4%)	
37-42	277 (39.9%)	20 (46.5%)	60 (40.5%)	41 (31.8%)	88 (44.4%)	68 (38.6%)	
>42	1 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.6%)	
Missing	115	4	14	46	14	37	
Timing of death							
Early pregnancy	55 (7.0%)	4 (8.5%)	13 (8.1%)	15 (9.1%)	8 (3.9%)	15 (7.1%)	<0.001
Antenatal	181 (22.9%)	15 (31.9%)	41 (25.6%)	30 (18.2%)	54 (26.1%)	41 (19.5%)	
Intrapartum	41 (5.2%)	3 (6.4%)	14 (8.8%)	3 (1.8%)	11 (5.3%)	10 (4.8%)	
Early postnatal (<24hrs)	284 (36.0%)	15 (31.9%)	58 (36.2%)	45 (27.3%)	91 (44.0%)	75 (35.7%)	
Late postnatal (24hrs-42days)	228 (28.9%)	10 (21.3%)	34 (21.2%)	72 (43.6%)	43 (20.8%)	69 (32.9%)	
Missing	20	0	2	10	5	3	
Mode of Delivery							
Spontaneous vaginal delivery	240 (45.0%)	12 (48.0%)	57 (58.8%)	46 (38.3%)	68 (47.2%)	57 (38.8%)	0.189
Breech	4 (0.8%)	1 (4.0%)	0 (0.0%)	1 (0.8%)	1 (0.7%)	1 (0.7%)	
Vacuum	10 (1.9%)	1 (4.0%)	2 (2.1%)	2 (1.7%)	2 (1.4%)	3 (2.0%)	
Destructive procedure	3 (0.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (1.4%)	1 (0.7%)	
Caesarean section	276 (51.8%)	11 (44.0%)	38 (39.2%)	71 (59.2%)	71 (49.3%)	85 (57.8%)	
Missing	276	22	65	55	68	66	

3.5.1 GESTATION

The average (median) gestation of women who died was 37.0 weeks (IQR 32.0, 38.0), with no significant difference between zones. Most women (277 [39.9%]) who died were at full term (between 37-42 weeks gestation). There was no significant difference between zones in the grouped gestational ages of women who died.

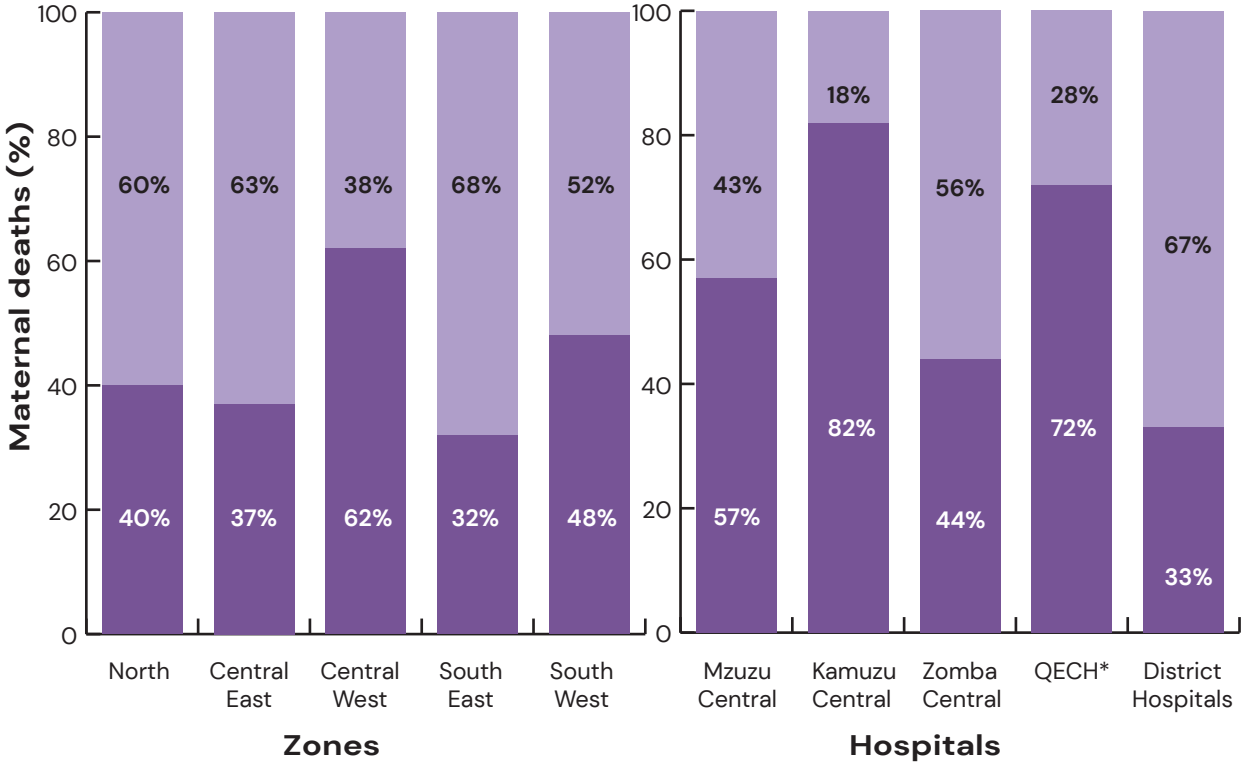
3.5.2 TIMING OF DEATH

Most maternal deaths occurred in the postnatal period (512, [64.9%]), predominantly within the first 24 hours after birth (284, [36.0%]) (Table 6). Postnatal deaths were followed in frequency by antenatal deaths (181 [22.9%]), deaths occurring in the early pregnancy period prior to 28 weeks gestation (55, [7.0%]), and intrapartum (41 [5.2%]) deaths.

There was a statistically significant difference in the stage of pregnancy at the time of death between zones. However, across all zones most deaths occurred postnatally; 53.2% (n=25) in the North, 57.4% (n=92) in the Central East, 70.9% (n=117) in the Central West, 64.8% (n=134) in the South East, and 68.6% (n=144) in the South West (Table 6).

Most postnatal deaths occurred in the early postnatal period (<24 hrs following delivery) compared to the late postnatal period (24hrs-42 days following delivery). The specific timing of postnatal deaths for zones, central hospitals and district hospitals is shown in Figure 4. The Central West registered a larger proportion of late postnatal deaths than other zones (43.6%), but a lower proportion of early postnatal deaths (27.3%) and antenatal deaths (18.2%). Conversely, the South East had a higher than average proportion of early postnatal deaths (44.0%), but a lower proportion of early pregnancy deaths.

Figure 4. Early (<24 hours) versus Late (24 hours- 42 days) Postnatal Deaths



QECH = Queen Elizabeth Central Hospital

3.5.3 MODE OF DELIVERY

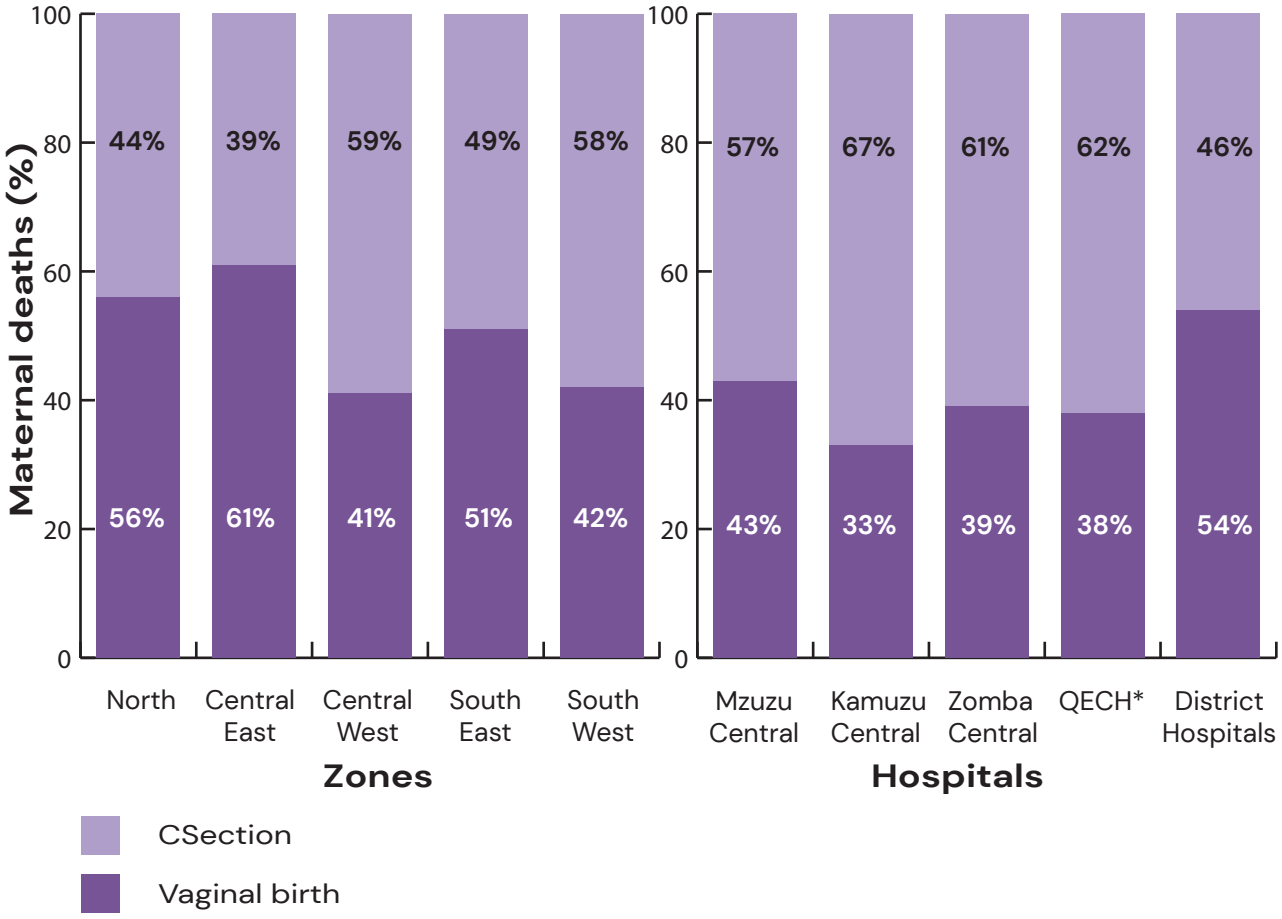
Amongst women who died following delivery, the majority (n=276 [51.8%]) died following a Caesarean section (CS) (Table 6, Table 7).

Table 7. Mode of delivery of women who died : Vaginal vs Caesarean section

Variable	Total (n=533) n (%)	North (n=25) n (%)	Central East (n=97) n (%)	Central West (n=120) n (%)	South East (n=144) n (%)	South West (n=147) n (%)	p value
Mode of Delivery							
Vaginal Delivery	257 (48.2%)	14 (56.0%)	59 (60.8%)	49 (40.8%)	73 (50.7%)	62 (42.2%)	**0.018**
Caesarean section	276 (51.8%)	11 (44.0%)	38 (39.2%)	71 (59.2%)	71 (49.3%)	85 (57.85)	

There was statistically significant variation in the mode of delivery of women who died between zonal regions when considering CS compared with all types of vaginal birth (p=0.018, Table 7). Figure 5 shows mode of delivery for women who died at zonal, central hospital and district hospital level. In the North, Central East and South East zones the percentage of women who died after delivering vaginally was higher than the percentage who delivering by CS. However, overall proportions remained similar and rates of CS among women who died were higher than the national CS rate (6%)9 and rates of CS across the participating facilities (16%6) across all zones (Figure 5).

Figure 5. Mode of Delivery: Vaginal vs CS Birth



QECH = Queen Elizabeth Central Hospital, CS = Caesarean Section

3.6 CAUSES OF MATERNAL DEATH

3.6.1 CAUSES OF MATERNAL DEATH: NATIONAL

The leading causes of maternal death nationally in the period August 2020-December 2022 were maternal infection (n=201, [24.8%]), postpartum haemorrhage (PPH) (n=165, [20.4%]) and eclampsia (n=108, [13.3%]) (Table 8). Classification of maternal deaths is discussed in the section 2.3. Causes of death contributing to less than 3% of deaths have been omitted from this table but are found in Appendix 4. Grouped causes of maternal death can be found in Appendix 3. Detailed and comparative analysis of maternal deaths from the three leading causes can be found in section 4.

Table 8. Causes of maternal death 2020-2022

Cause of Death	Number of deaths	Proportion of deaths (%)
Maternal infection	201	24.8%
Postpartum haemorrhage	165	20.4%
Eclampsia	108	13.3%
Undetermined	71	8.8%
Ruptured uterus	68	8.4%
Pre-eclampsia	53	6.6%
Antepartum haemorrhage	39	4.8%
Abortion/miscarriage	29	3.6%

In 71 cases it was not possible to determine a cause of death following review of the MDA-2 form by the local MDSR committee and an independent obstetrician conducting a second review of deaths. It should be noted that 23 deaths resulting from septic abortion/miscarriage are included within "maternal infection". In 14 of the 52 deaths (27.0%) which followed abortion/miscarriage, it was disclosed by the woman or her relatives that the abortion was induced.

3.6.2 CAUSES OF MATERNAL DEATH: BY ZONE

Across the five administrative zones of Malawi, the leading causes of maternal death were found to be significantly different (Table 9). Maternal deaths resulting from infection were highest in the Central West region and were the most common cause of maternal death in this zone, as well as in the Northern and South-Western Zones. Deaths from infection were lowest in the South-East and Central East zones, where they were below the national level[2]. Deaths from PPH were the most common cause of maternal death in the South East Zone and the Central East Zone, but were lower than the national level in the Central West and Northern Zones[3] (Table 9).

[2] P value for difference in distribution of infection-related deaths across zones, p=0.010
[3] P value for difference in distribution of deaths from postpartum haemorrhage across zones, p=0.039

Table 9. Causes of maternal death by zone

Cause of Death	Total (n=809) n (%)	North (n=47) n (%)	Central East (n=162) n (%)	Central West (n=175) n (%)	South East (n=212) n (%)	South West (n=213) n (%)	p value
Maternal Infection	201 (24.8%)	12 (25.5%)	32 (19.8%)	46 (26.3%)	41 (19.3%)	70 (32.9%)	**<0.001**
Postpartum haemorrhage	165 (20.4%)	8 (17.0%)	34 (21.0%)	26 (14.9%)	54 (25.5%)	43 (20.2%)	
Eclampsia	108 (13.3%)	8 (17.0%)	24 (14.8%)	22 (12.6%)	25 (11.8%)	29 (13.6%)	
Ruptured uterus	68 (8.4%)	4 (8.5%)	19 (11.7%)	8 (4.6%)	23 (10.8%)	14 (6.6%)	
Pre-eclampsia	53 (6.6%)	0 (0.0%)	12 (7.4%)	21 (12.0%)	6 (2.8%)	14 (6.6%)	
Antepartum haemorrhage	39 (4.8%)	3 (6.4%)	9 (5.6%)	5 (2.9%)	13 (6.1%)	9 (4.2%)	
Abortion/ miscarriage	29 (3.6%)	1 (2.1%)	13 (8.0%)	4 (2.3%)	6 (2.8%)	5 (2.3%)	

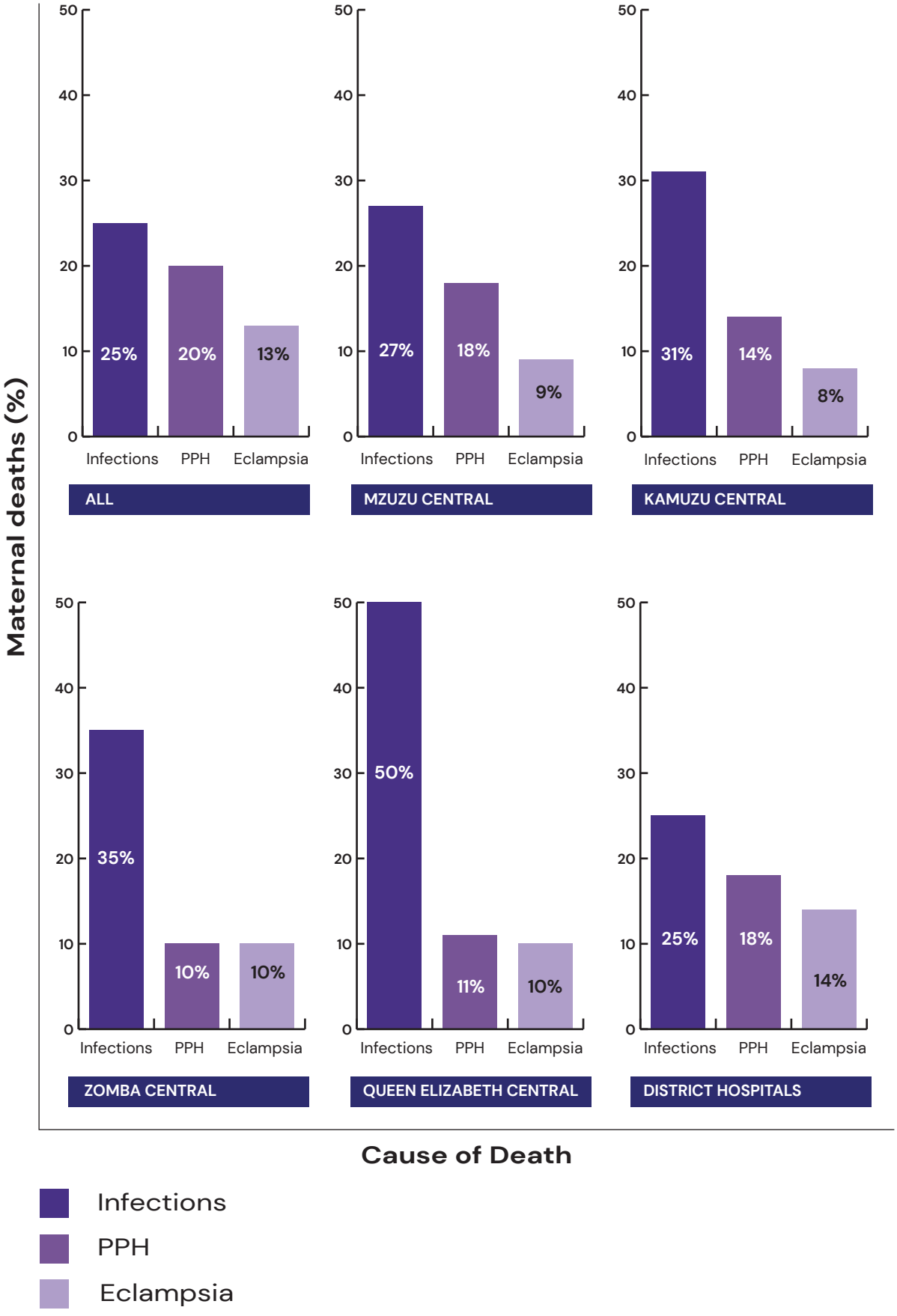
3.6.3 CAUSES OF MATERNAL DEATH: BY FACILITY

Causes of death for each central hospitals and all district hospitals are shown in Figure 6. The leading causes of death by individual facilities are given in Appendix 5.

Infection-related deaths constituted the highest proportion of deaths at the Central hospital level, whilst deaths from PPH predominated at the district level (Figure 6). Proportions of deaths from infection at Central hospital level ranged from 27-50% of all maternal deaths. Infection-related deaths were highest at Queen Elizabeth Central Hospital (n=54/107, [50.5%]). However, both Queen Elizabeth Central and Kamuzu Central were outliers in terms of infection-related deaths, contributing 26.9% (n=54) and 14.4% (n=29) respectively to national deaths from infection. Over three-quarters of deaths from infection at both KCH (93% of deaths from infection) and QECH (78%) were referred from other facilities. The second-leading causes of death at central hospital level varied. Postpartum haemorrhage was the second-leading cause of death at Mzuzu Central, eclampsia at Kamuzu Central, and abortion-related deaths at both Queen Elizabeth and Zomba Central hospitals (Figure 6).

The leading causes of death by individual facilities are given in Appendix 5.

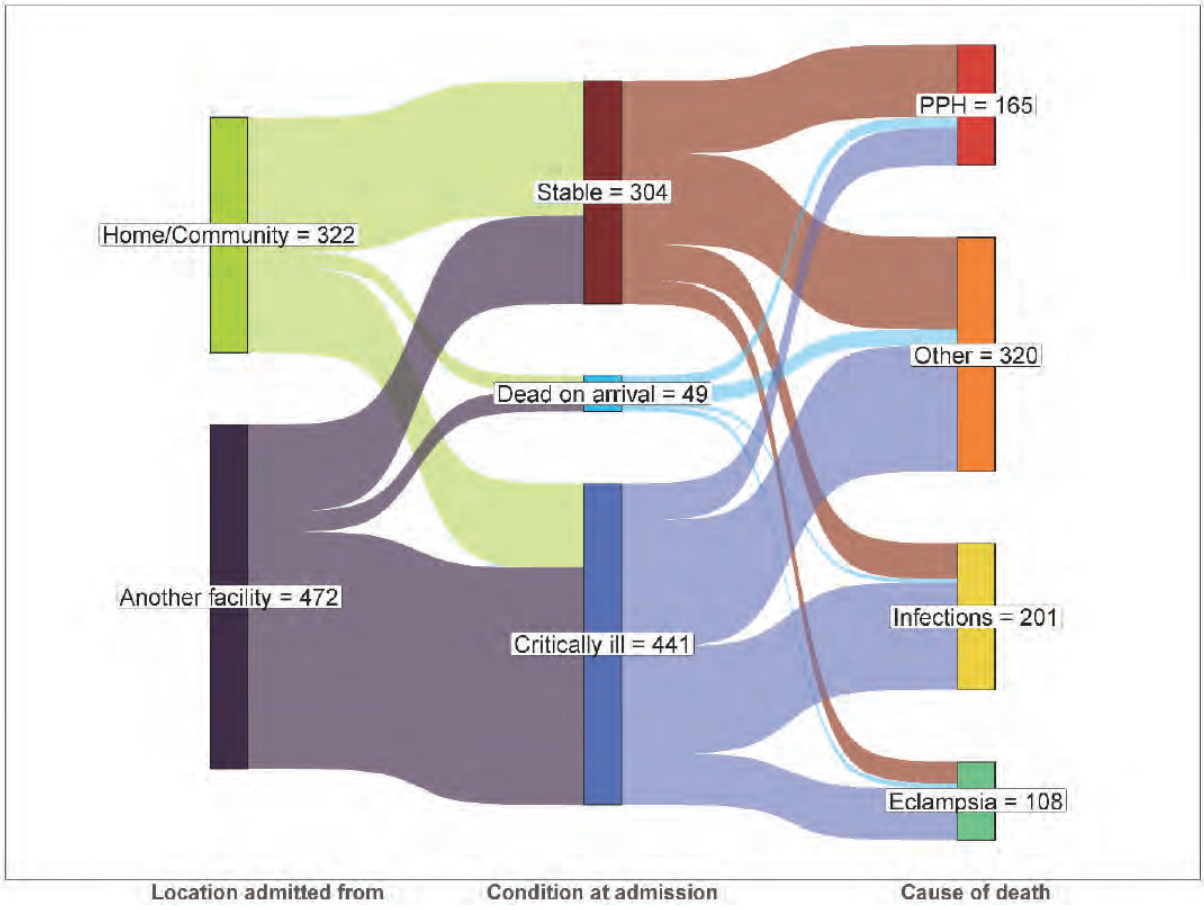
Figure 6. Cause of death by Central Hospital



3.7
LOCATION ADMITTED FROM, CONDITION ON ARRIVAL AND CAUSE OF DEATH

Figure 7 shows the flow of women who died, originating from the home/community setting or a healthcare facility, arriving to the facility where they died either stable, dead on arrival or in critically ill condition, and ultimately their cause of death.

Figure 7. Location admitted from, condition at admission and cause of death



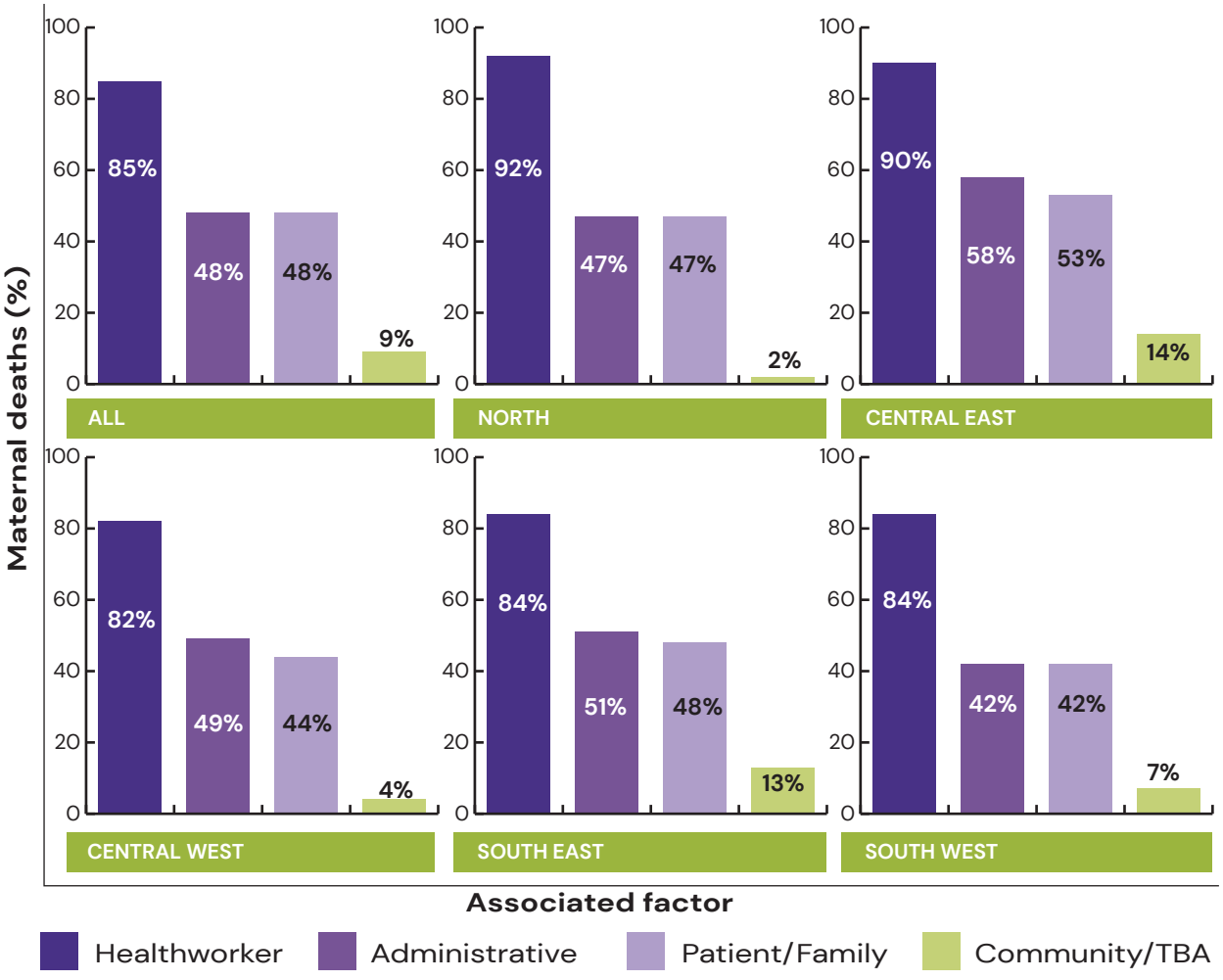
3.8
CAUSES OF MATERNAL DEATH

3.8.1 CAUSES OF MATERNAL DEATH: NATIONAL

MDSR committees reviewing deaths locally determined avoidable factors associated with each death. Of the four broad categories of factors, "healthcare worker factors" were most frequently associated with maternal deaths (688 [85%] of 809 deaths), followed by "patient/family factors" (n=390, [48.2%]), "administrative factors" (n=384, [47.5%]), and finally "community/traditional birth attendant (TBA) factors" (n=72, [8.9%]). See Appendix 9 for full breakdown by zone and sub-category.

Figure 8 shows associated factors for all maternal deaths by zone. There was no statistically significant difference in the assigning of "healthcare worker" or "administrative" factors between different zones (p=0.202 and p=0.285 respectively). However, there was a significant difference between the assigning of "patient/family" factors (p=0.020) and "community/TBA factors" (p=<0.001) between the zones, with higher frequency of both these factors in deaths occurring in the South East and Central East zones.

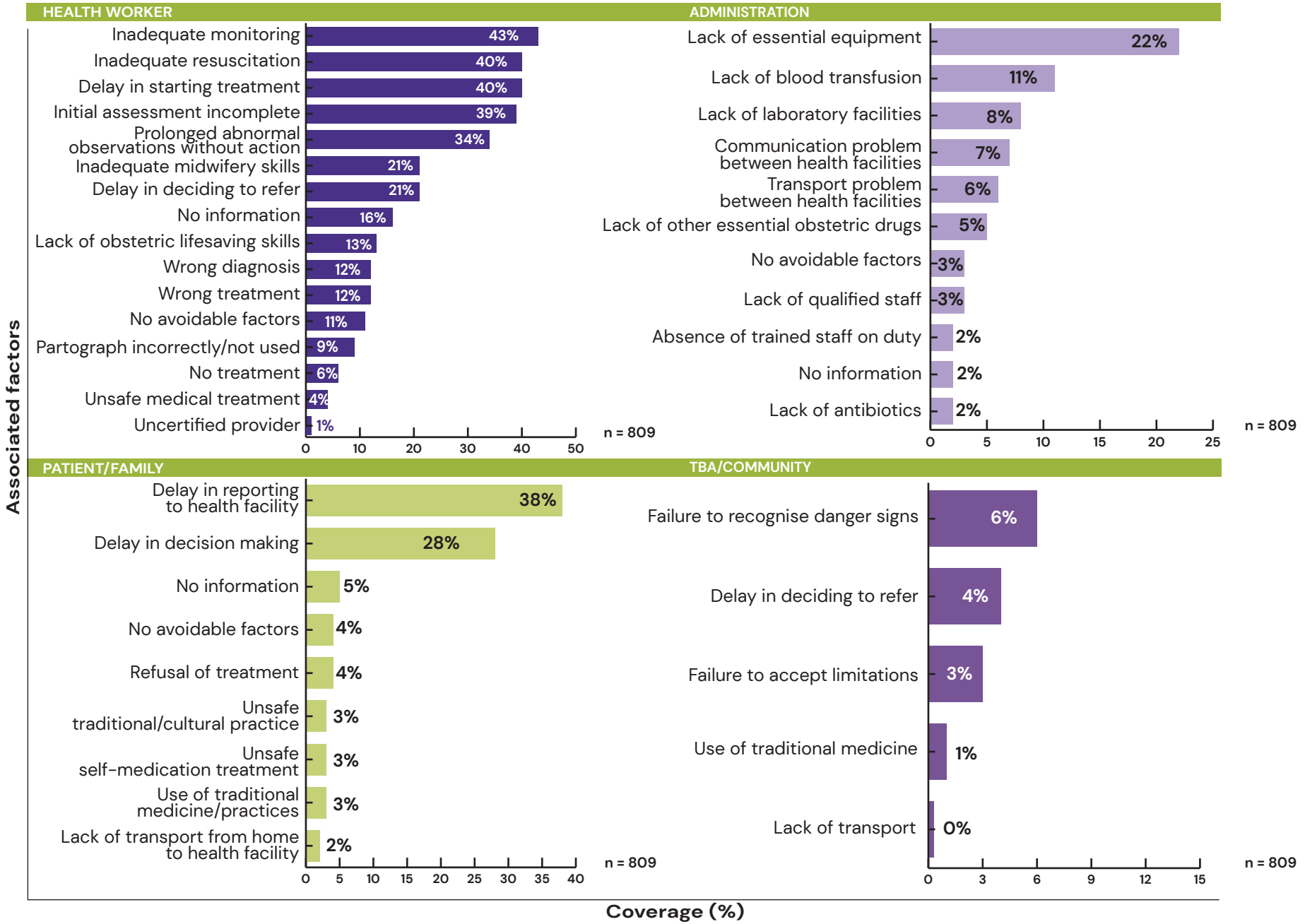
Figure 8. Factors associated with maternal deaths by zone: Broad Categories



3.8.2 ASSOCIATED FACTORS: SUBCATEGORIES

Figure 9 shows each category of associated factor further broken down by subcategory.

Figure 9. Avoidable factors associated with maternal deaths



Across all categories and subcategories, the most frequently assigned avoidable factors were "inadequate monitoring" (43% of 809 deaths), "inadequate resuscitation" (40%), "delay in starting treatment" (40%), "initial assessment incomplete" (39%), "delay in [patient/family] reporting to a health facility" (38%), "prolonged abnormal observations without action" (34%), "delay in decision-making" (28%), "lack of essential equipment" (22%), "inadequate midwifery skills" (21%) and "delay in deciding to refer" (21%), "lack of obstetric life-saving skills" (13%), "wrong diagnosis" (12%), "wrong treatment (12%) and "lack of blood transfusion" (11%). No other single factor was assigned to more than ten per cent of deaths (Figure 9.)

The relative contributions of avoidable factors to deaths from the three leading causes (infection, PPH, eclampsia) are discussed in Section 4.

3.9
NEONATAL OUTCOMES FOR BABIES OF WOMEN WHO DIED

Table 10. Neonatal outcomes for babies of women who died

Variable	Total (n=572) n (%)	North (n=27) n (%)	Central East (n=162) n (%)	Central West (n=129) n (%)	South East (n=153) n (%)	South West (n=156) n (%)	p value
Number of babies born							
Singleton	480 (89.9%)	24 (96.0%)	90 (91.8%)	105 (87.5%)	125 (86.2%)	136 (93.2%)	**0.012**
Twins	43 (8.1%)	0 (0.0%)	7 (7.1%)	12 (10.0%)	14 (9.7%)	10 (6.8%)	
Triplets	2 (0.4%)	1 (4.0%)	1 (1.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Missing	47 (8.1%)	2 (7.45)	9 (8.4%)	12 (9.1%)	14 (8.8%)	10 (6.4%)	
Birth weight							
Very low (<1500g)	41 (9.1%)	1 (5.6%)	6 (7.2%)	9 (10.2%)	7 (5.2%)	18 (14.2%)	**0.098**
Low (1500 -2000g)	153 (33.9%)	5 (27.8%)	24 (28.9%)	30 (34.1%)	58 (43.0%)	36 (28.3%)	
Normal (>2500g)	257 57.0%)	12 (66.7%)	53 (63.9%)	49 (55.7%)	70 (51.9%)	73 (57.5%)	
Missing	130 (22.4%)	9 (33.3%)	24 (22.4%)	44 (33.3%)	24 (15.1%)	29 (18.6%)	
Outcome							
Alive	361 (63.1%)	17 (63.0%)	72 (67.3%)	80 (62.0%)	95 (62.1%)	97 (62.2%)	**0.009**
Fresh stillbirth	126 (22.0%)	5 (18.5%)	28 (26.2%)	18 (14.0%)	43 (28.1%)	32 (20.5%)	
Macerated stillbirth	43 (7.5%)	1 (3.7%)	3 (2.8%)	16 (12.4%)	9 (5.9%)	14 (9.0%)	
Neonatal death	42 (7.3%)	4 (14.8%)	4 (3.7%)	15 (11.6%)	6 (3.9%)	13 (8.3%)	
Missing	9 (1.5%)	0	0	3 (2.35%)	6 (3.8%)	0	

Table 11. Causes of neonatal death for babies of women who died

Cause of neonatal death	Total (n=572) n (%)	North (n=27) n (%)	Central East (n=107) n (%)	Central West (n=129) n (%)	South East (n=153) n (%)	South West (n=156) n (%)	
Prematurity	14 (6.6%)	0 (0.0%)	3 (8.6%)	4 (8.2%)	1 (1.7%)	6 (10.2%)	
Low birth weight	3 (1.4%)	1 (10.0%)	0 (0.0%)	0 (0.0%)	1 (1.7%)	1 (1.7%)	
Asphyxia	80 (37.9%)	4 (40.0%)	11 (31.4%)	7 (14.3%)	28 (48.3%)	30 (50.8%)	
Hypothermia	1 (0.5%)	1 (10.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Sepsis	2 (0.9%)	0 (0.0%)	0 (0.0%)	1 (2.0%)	1 (1.7%)	0 (0.0%)	
Neonatal tetanus	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Diarrhoea	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Congenital anomaly	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Other	46 (21.8%)	3 (30.0%)	10 (28.6%)	13 (26.5%)	13 (22.4%)	7 (11.9%)	
Unknown	65 (30.8%)	1 (10.0%)	11 (31.4%)	24 (49.0%)	14 (24.1%)	14 (24.1%)	

04.

FOCUS ON LEADING CAUSES OF MATERNAL DEATH

4.1 FOCUS ON DEATHS FROM MATERNAL INFECTION: TECHNICAL BRIEF

"Maternal sepsis is a life-threatening condition defined as organ dysfunction resulting from infection during pregnancy, childbirth, post-abortion, or postpartum period" [8]

Infection is the leading cause of maternal death in Malawi. 201 women died from an infection in pregnancy or the peripartum period, contributing to 24.8% (n=201/809) of all maternal deaths.

BOX 1. WOMEN DYING OF INFECTION:

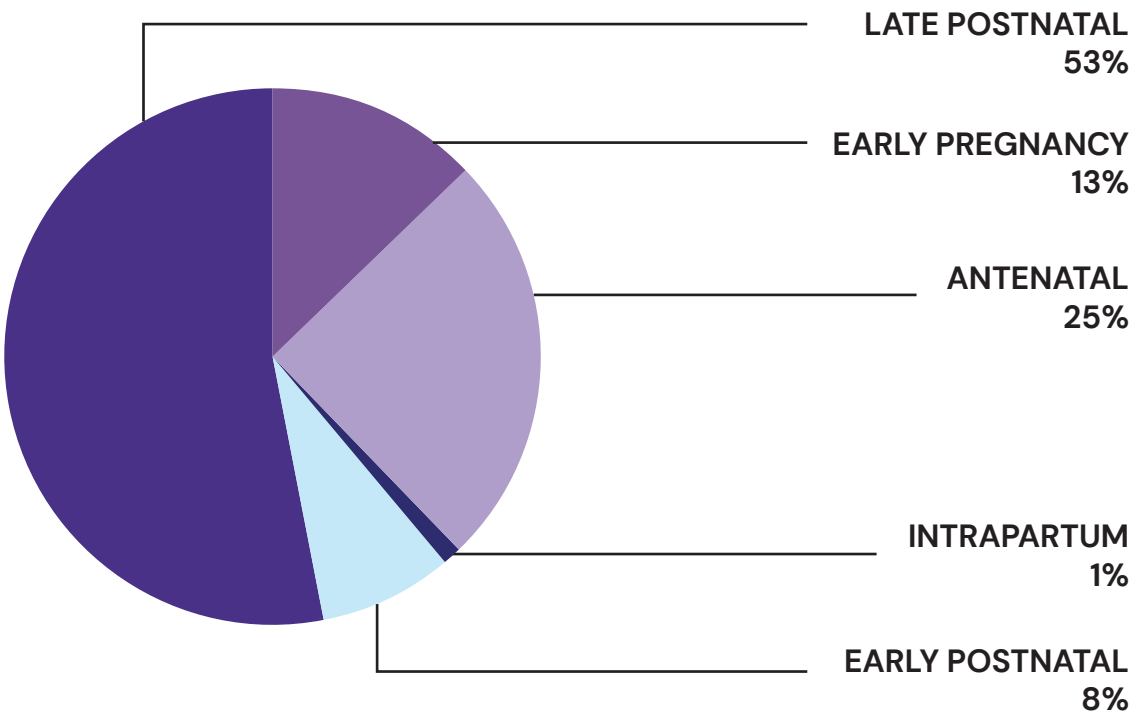
...were mostly referred from another facility and were critically ill on arrival at the referral centre.
...died of infection in the late postnatal period (24hrs-42 days after giving birth)
... were more likely to be HIV positive and less likely to be taking ARVs than women dying of other causes.

Of women dying in early pregnancy following complications of abortion/miscarriage, 35.1% died after septic abortion/miscarriage.

Half of the women dying from infection died of infections directly caused by pregnancy, and half died from other infectious diseases, likely to have been exacerbated by their pregnancy.

Women died of infections directly related to pregnancy including chorioamnionitis, puerperal sepsis, and septic abortion (n=98/809, 12.1% of all deaths) as well as infections such as malaria, Covid-19, tuberculosis, and pneumonia (n=103/809, 12.7%), which may have been exacerbated by pregnancy. These infections are considered together in accordance with the most recent WHO definition of maternal sepsis which does not make distinctions on the aetiology of maternal infection[8] (see section 2.3).

Figure 10. Timing of maternal death from infection



Timing of Death. Most women dying of infection did so in the postnatal period, specifically in the period 24 hours to 42 days after birth (Figure 10). Of the 65 women who died in early pregnancy following complications of abortion/miscarriage, 35.1% died of infection (septic miscarriage/abortion).

Age and Parity. Older women were more likely than younger women to die of infection rather than other causes, with women over the age of 35yrs more likely than women under the age of 20yrs to die of infection. Parity had no significant impact on risk of dying of infection compared to dying of other causes.

HIV Status. Those dying of infection were almost three times more likely to be HIV positive rather than negative compared with those dying of other causes, and less likely to be taking ARVs.[4]

Antenatal Care. Women who received no antenatal care were more likely to die of infection than to die of other causes; particularly if they had less than four visits[5].

Giving Birth. For those who survived until the point of delivery, the majority of women who died of infection delivered vaginally (n=70/122, 57.4%). The remaining 42.6% delivered by CS (n=52/122); higher than the average CS rate across the facilities (16%)[6] and higher than the national CS rate (6%)[9]. Most women who died of an infection following CS died of an infection directly related to pregnancy (n=38/52, 73.0%).

[4] Odds ratio for HIV positive rather than HIV negative when compared to women dying of other causes = OR 2.84 (CI:1.71;4.7, p<0.001) and Odds ratio for taking ARVS rather than not taking ARVs = OR 0.36 (CI:0.14;0.93, P=0.036).
[5] Odds ratio for 4 or more antenatal visits rather than <4 visits compared to women dying of other causes = OR 0.63 (CI:0.41;0.96, p=0.033)
[6] Odds ratio for critically ill rather than stable on admission when compared with women who died of other causes = OR=2.6 (CI:1.82;3.77, p<0.001

Where women came from and their condition on arrival. Most women who died of infection were admitted from another facility (n=128/201, 63.6%), rather than home/community (n=69, 34.3%). Most were critically ill on admission (n=147, 73.1%), followed by those stable on admission (n=49, 24.3%) and those dead on arrival (n=5, 2.5%). Women dying of infection were over twice as likely to be critically ill rather than stable on admission when compared with women dying of other causes.[6] This could indicate that maternal infection is being poorly recognised and managed either in the home setting or in the facility where the woman originated prior to transfer.

Geography of infection-related deaths. The highest proportion of deaths due to maternal infection was in the South West zone (n=70/213, 32.9%). However, infection was the leading cause of death in the North (n=12/47, 25.5% of all deaths), Central West (n=46/175, 26.3%) and South West zones.

Avoidable Factors. Lack of antibiotics was more likely to be associated with deaths from infection than deaths from other causes[7], although this was only a factor in 4% of deaths from infection (n=15). The most commonly assigned factors in death from infection are shown in Box 2 and all subcategories of associated factors are shown in Figure 11.

BOX 2. FACTORS ASSOCIATED WITH MATERNAL DEATHS FROM INFECTION

Delay in patient/family reporting to facility – 41%
Delay in starting treatment – 40%
Initial assessment incomplete – 40%
Inadequate monitoring – 38%
Inadequate resuscitation – 34%
Prolonged abnormal observations without action – 33%

[7] Odds ratio for "lack of antibiotics" being a factor in death from infection compared with deaths from other causes = OR=4.7 (1.67;14.19, P=0.004)

CASE STUDIES: MATERNAL INFECTION

Infection case 1: A 32 year old para 3 with gestational age 20 weeks was admitted to the district hospital due to shortness of breath. She had a sore throat and had been coughing for 3 days. Upon admission her BP was checked 132/67, her pulse was 103, her saturation was 86% on room air and her temperature was 37,8 degrees. She was commenced on oxygen, and a COVID-19 rapid test was done, which was positive. She was moved to the isolation ward, but was deteriorating on 15L O2/min. A decision was made to refer to Central hospital for ICU, but 5 hours later, she died before the ambulance arrived.

Infection case 2: A 17 year old para 1 was referred to the Central hospital 14 days post CS with fever and an oozing abdominal wound. Upon examination she was tachycardic, tachypnoeic with a temperature of 38.7 degrees with normal BPs. Her CS wound was open, pus was draining from the wound and the vagina, and her abdomen was very tender. She was resuscitated and taken to theatre for an exploratory laparotomy. In theatre it was noted that the sutures in her uterus had opened, and the uterus was necrotic with pus leaking into the abdomen. A hysterectomy was performed, and post-operative antibiotics were commenced. In the postnatal ward she was persistently tachycardic and febrile. After 3 days, she arrested; CPR was attempted but failed.

Infection case 3: A 42 year old HIV-positive para 3 was admitted to district hospital with bleeding, foul smelling discharge, and hypovolaemic shock following one month amenorrhea. She reported to have induced an abortion using local herbs. Upon admission, she had low oxygen sats of 90% and anaemia. An evacuation of her uterus was performed the following day. She was transfused 4 units of whole blood, and received ceftriaxone and metronidazole. The condition continued deteriorating until 2 days later she passed away. At the time of her death it was noted that she had not had vital signs monitored since the surgical procedure.

RECOMMENDATIONS TO REDUCE DEATHS FROM MATERNAL INFECTION

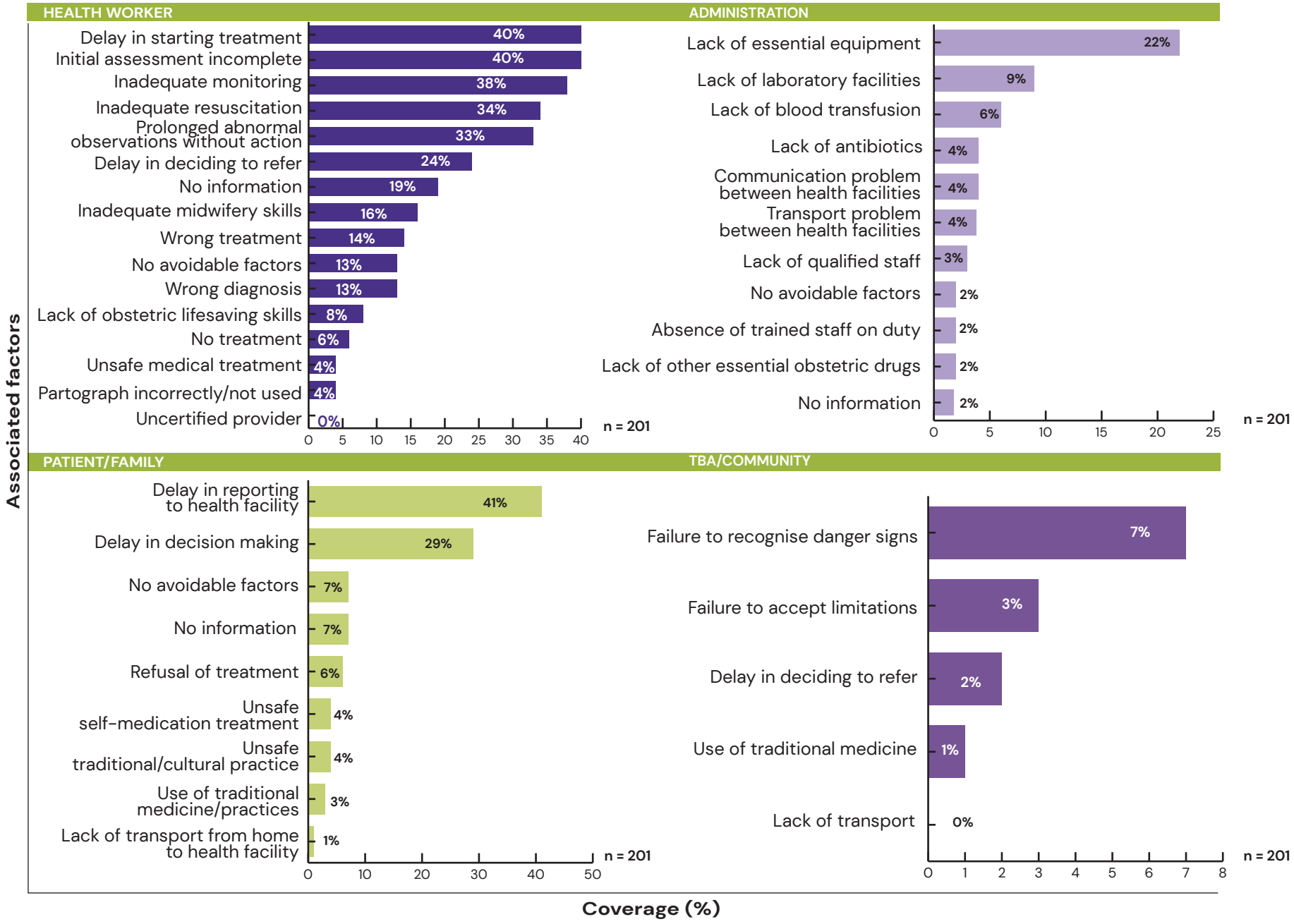
In conjunction with wider recommendations, stakeholders agreed specific actions required to reduce deaths from infection:

1. **Provide education to pregnant women about the risks of infection and how to prevent and recognise infection.** This should include advice to bathe prior to admission, the need for clean sanitary pads/towels during and after labour, and danger signs to look out for. This could be delivered through health service assistants (HSAs), community midwife assistants, antenatal midwives and community leaders and by strengthening their role in the community.

2. **Strengthen infection prevention and control (IPC) practices amongst HCWs through:**
   a. **Improving resources for sterile vaginal examination** such as antiseptic, gloves, gauze, sterile field
   b. **Adopting a national protocol of vaginal preparation immediately prior to Caesarean section** to reduce the risk of endometritis and peritonitis
   c. **Improving monitoring of infection prevention practices** through regular audit and Quality Improvement activities.

3. **Improve availability of newer generations of antibiotics** such as carbapenems, fourth generation penicillins or cepahlosporins and improve targeted antibiotic therapy by improving capacity for culture and resistance profiling of organisms

Figure 11. Factors associated with maternal deaths from infection



4.2 FOCUS ON DEATHS FROM POSTPARTUM HAEMORRHAGE: TECHNICAL BRIEF

"PPH is the loss of blood of more than 500ml following birth"[10]
PPH is the second-leading cause of maternal death in Malawi. 165 women died of postpartum haemorrhage (PPH) in the period of this report, contributing to 20.4% of maternal deaths.

BOX 3. WOMEN DYING OF PPH:

...Were mostly referred from another facility and were stable on arrival at the referral centre.
...Died of PPH within 24hrs of giving birth; the majority having given birth vaginally.
...Were significantly more likely to have had a vacuum delivery than women dying of other causes
...Were no different in age or HIV status than women dying of other causes
...Were more likely to have given birth at least once before than women dying of other causes

30% of women who died of PPH had a retained placenta following a vaginal delivery
Almost half of women who died of PPH had had a Caesarean section

Timing of Death. Most women who died of PPH died in the early postnatal period (n=132/165, 80.0%), within the first 24 hrs after birth.

Age. There was no significant difference in the age of women dying of PPH compared to the age of women dying of other causes (27·0 years versus 28·0 years, p value= 0·995). Women who died of PPH were more likely to have received antenatal care than those women who died of other causes[8], but were no more likely to have had danger signs identified antenatally.

Parity. Women who had given birth previously at least once were at significantly increased risk of death from PPH compared to death from other causes. For example, women with 4 or more previous births were 4.5 times more likely than women with no previous births to die from PPH than other causes[9].

HIV Status. There was no significant association between HIV status and death from PPH compared with other causes of death.

Giving birth. Women who died of PPH were around twice as likely to have delivered vaginally than by Caesarean section when compared with women who died of other causes[10]. However, 41.2% (n=68/165) of women who died of PPH had

[8] Odds ratio for receiving antenatal care rather than no antenatal care for women dying of PPH compared to other causes = OR 6.0 (2.8;15.61, p<0.001)
[9] Odds ratio for four or more previous births rather than no previous births compared with women who died of other causes = OR 4.58, CI:0.2;12.45, p<0.001
[10] Odds ratio for delivery by CS rather than vaginal delivery compared with women who died of other causes = OR 0.58, CI:0.4;0.84, p=0.004

a Caesarean Section, whilst overall only 16% of women delivering at the same facilities had Caesarean sections, and 6% of women nationally. Women who died of PPH were around four times more likely to have delivered by vacuum than spontaneously compared to women who died of other causes[11]. Approximately 29.9% (n=29/97) of women who died of PPH after a vaginal birth had a retained placenta. Data on retained placenta was not formally collected, but was extracted on a case-by-case basis from narratives recorded on the MDA-2 form.

Where women came from and their condition on arrival. Women who died of PPH were more likely to be in a stable condition on arrival at the facility (n= 99/165, 60.0%) than to be critically ill (n=51/165, 30.9%) when compared with women who died of other causes[12]. Only a small number of women were dead on arrival at the facility (n=15/165, 9.1%). This suggests that women are deteriorating in the facility where they died. Most women who died of PPH were admitted to the facility where they died from another facility (n=94/165, 57.0%). Interventions received by women who died of PPH are shown in Box 4.

Geography of deaths from PPH. Postpartum haemorrhage (PPH) was the leading cause of death in the Central East and the South East zones. The proportion of women dying of PPH was highest in the South East Zone (n=54/213, 25.5% of death). Women in the Central West zone were less likely to die of PPH than of other causes[13].

BOX 4. MANAGEMENT OF PPH

Uterotonics – 53%
Fluids – 66%
Blood transfusion – 53%
Tranexamic acid – 1.2%
Non-Pneumatic Antishock Garment – 6.1%
Laparotomy – 27.9%
Hysterectomy – 24.2%
Intensive Care = 15.8%

Associated Factors. Healthcare worker factors were more frequently and significantly associated with deaths from PPH compared to deaths from any other cause, and were present in 93.45 of cases[14]. In this category, deaths from PPH were significantly more frequently associated with several other factors compared to deaths from other causes; "inadequate resuscitation", "inadequate monitoring", "inadequate midwifery skills", "lack of obstetric lifesaving skills" and "partograph incorrectly or not used".

Administrative factors were also more frequently associated with deaths from PPH compared to deaths from other causes, specifically "lack of blood transfusion", "communication problems between facilities", and "transport problems between facilities".

A breakdown of factors associated with deaths from PPH are shown in Figure 12.

[11] Odds ratio for delivery by vacuum rather than vaginal delivery compared with women who died of other causes = OR 4.25, CI:1.15;20.13, p=0.04
[12] Odds ratio for critical condition on arrival rather than stable condition when compared with women who died of other causes = OR 0.27, CI:0.18; 0.39, p<0.001
[13] Odds ratio for location in Central West zone rather than other zones for women dying of PPH compared to other causes = OR 0.51 (0.3;0.85, p=0.011)
[14] 154 [93·4%] of 165 from PPH vs 534 [82·9%] of 644 deaths from other causes, p<0·001.

CASE STUDIES: PPH

PPH Case 1: A 25-year-old para 2 was referred to the Central hospital from the health centre in the latent phase of labour, due to a suspected large for gestational age baby based on fundal height. Her labour was long, but uneventful. Following the birth, she began to bleed. She was given oral misoprostol and intravenous fluids and a non-pneumatic antishock garment was used. Packed red cells were given, but fresh frozen plasma and platelets were unavailable. Plans were made for emergency surgery, but this was delayed by several hours due to an ongoing procedure occupying the operating theatre as there were not enough staff available to open a second theatre. Later, a hysterectomy was performed. During the procedure, the woman had a cardiac arrest. CPR was unsuccessful.

PPH Case 2: A para 7 presented to the District hospital in active labour. No vital signs, history or examination were taken on admission. She gave birth one hour after arrival at the facility and began to bleed. The placenta was retained. Attempts to manually remove it on the labour ward were unsuccessful. She continued to bleed, but no IV fluids or medical management of PPH was instigated. After two hours, she was transferred to theatre. The placenta was removed, a subtotal hysterectomy was done, and she received a two-unit blood transfusion. Despite this, she passed away.

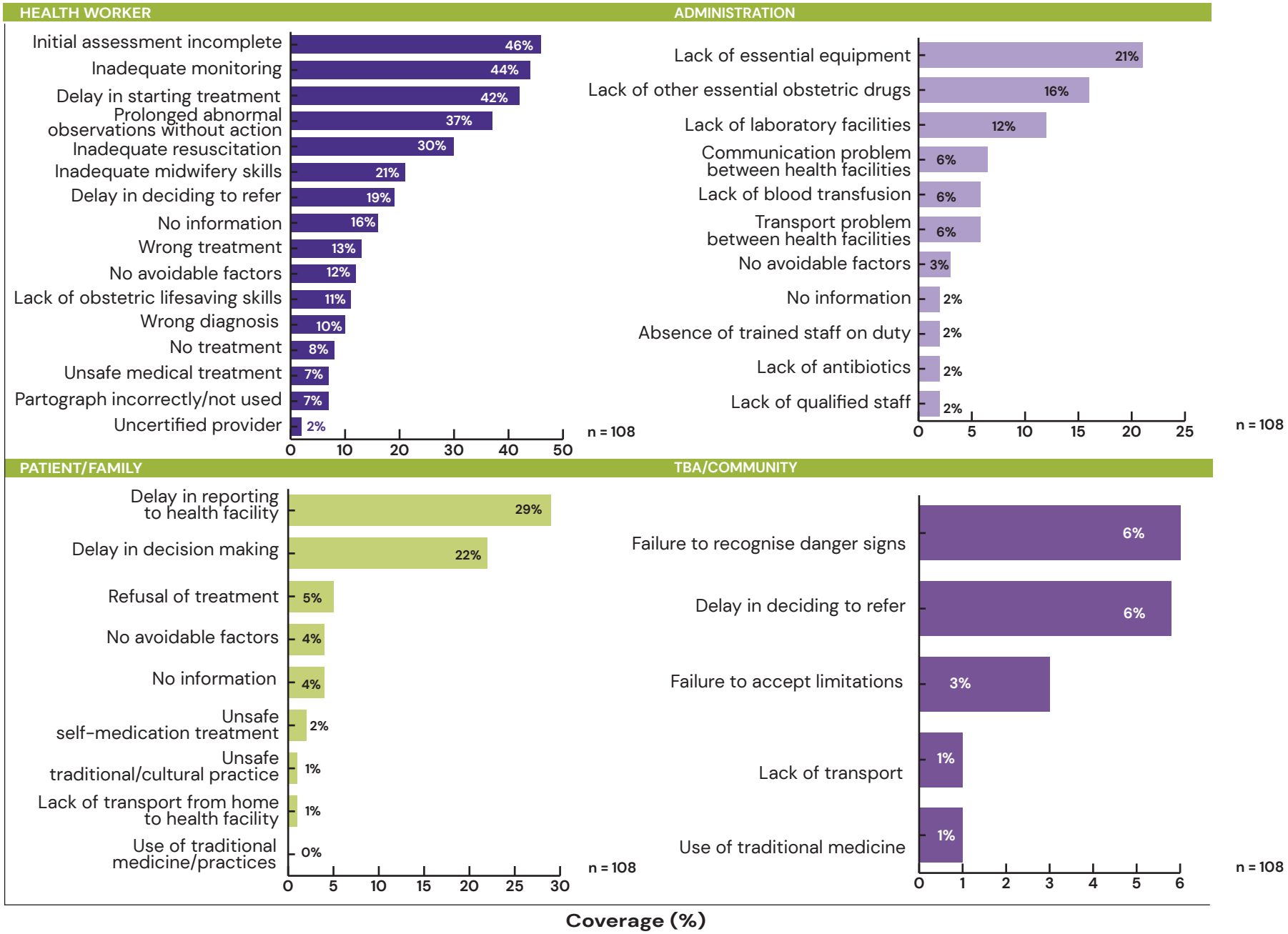
PPH Case 3: A 21-year-old para 1 with one previous CS presented to the district hospital in latent phase of labour at 4cm dilatation. She was reviewed and an emergency CS. Her haemoglobin was 5.8 g/dL. Blood for transfusion was not available. It was decided to proceed with the emergency surgery due to concerns about the risk of uterine rupture. The procedure was delayed due to a lack of sterile CS sets. A further vaginal examination was not carried out. During CS, the foetal head was impacted and there were extended tears. The woman was transferred to the postnatal ward. Several hours later, blood was noted oozing from the dressing site. She returned to theatre for laparotomy where active bleeding was noted. A total abdominal hysterectomy was performed, and the abdomen was packed with gauze. On arrival to the postnatal ward her vital signs were recorded; BP 73/37, Temperature 34.7, saturation 81%. She was commenced on oxygen therapy, vital signs were checked twice more. She died around two hours later.

RECOMMENDATIONS TO REDUCE DEATHS FROM PPH

In conjunction with wider recommendations, stakeholders agreed specific actions to reduce deaths from post-partum haemorrhage:

1. Engage with communities to discourage harmful traditional practices such as the use of local Pitocin.
2. Improve early detection and treatment of anaemia through increased availability of full blood count testing.
3. Ensure supply of and training of staff in the use of tranexamic acid to prevent and manage bleeding. Add to essential drug list.

Figure 12. Factors associated with deaths from PPH



4.3
FOCUS ON DEATHS FROM ECLAMPSIA

"Eclampsia is the development of generalised seizures in pregnancy or postnatally, usually as a complication of pre-eclampsia, a hypertensive disease of pregnancy"[11]

Eclampsia is the third-leading cause of death in Malawi. 108 women died of eclampsia, contributing to 13.3% of maternal deaths.

BOX 5. WOMEN DYING OF ECLAMPSIA:

...were younger than women dying of other causes
...received antenatal care, but did not have danger signs documented
...were likely to be admitted from another facility and be critically ill on arrival
...were mostly known to have pre-eclampsia or eclampsia on arrival to the referral facility
...mostly gave birth by Caesarean section

Around two thirds of women died in the postnatal period, and one third in the antenatal period

Timing of Death. Deaths were distributed almost equally between the early postnatal period (n=34/108, 31.5%), the antenatal period (n=32/108, 29.6%) and the late postnatal period (n=31/108, 28.7%). A minority of women died in the intrapartum period (n=7/108, 6.5%) and prior to 28 weeks gestation (n=2/108, 1.9%).

Age. Women who died of eclampsia were more likely to be under 20 years of age than over the age of 20 years when compared to women dying of other causes[15]
.

Parity. Women who had had 2 or more previous births were less likely to die from eclampsia than other causes of maternal death[16].

HIV Status. Women who were HIV positive were significantly less likely to die of eclampsia than other causes[17].

Antenatal Care. The majority of women who died of eclampsia received antenatal care (n=84/108, 77.7%), but only 20.2% (n=17/84) of those had danger signs noted; it is not reported whether these were related to the development of hypertensive disease or not.

[15] Odds ratio for <20 years rather than 20-25 years = OR 0.38 (CI:0.21;0.68), Odds ratio for 26-35 years = OR 0.48 (CI0.28;0.82), Odds ratio for >35 years = OR 0.32 (0.16;0.61) compared to women who died of other causes.
[16] Odds ratio for death from eclampsia rather than other causes in women 2 births vs 0 previous births = OR 0.42 (CI:0.18;0.93), in women with 4 or more births vs 0 previous births OR = 0.21 (0.09;0.48)
[17] OR=0.32(CI:0.09;0.79)
[18] OR for admission from Home rather than another facility compared to women who died of other causes = OR 0.59 (CI:0.37;0.92). OR for critically ill at admission rather than stable compared to women who died of other causes = OR 1.66 (CI:1.07;2.64)

Giving Birth. There was no statistically significant difference in the mode of delivery between women who died of eclampsia when compared with women who died of other causes, although the majority died following a Caesarean section (n=41/69, 59.4%)

Where women came from and condition on arrival. Women were significantly more likely to be admitted from another facility (n=76/108, 70.4%) than from home, and more likely to be critically ill (n=70/108, 64.8%) than stable (n=31/108, 28.7%) on admission when compared to women who died of other causes[18]. Most women who died of eclampsia were identified as having pre-eclampsia or eclampsia (n=74/108, 69.4%) at admission. The remainder were admitted for other reasons (e.g. labour).

BOX 6. MANAGEMENT OF ECLAMPSIA IN WOMEN WHO DIED

Anti-hypertensives – 60.2% (65/108)
Anti-convulsants – 73.1% (79/108)

Geography of deaths from Eclampsia. There was no significant geographical variation across the zones of Malawi in the risk of death from eclampsia when compared to deaths from other causes.

Avoidable Factors. Deaths from eclampsia were more likely to involve lack of essential obstetric drugs[19]. Shortage of drugs was a factor in 16% of deaths from eclampsia (n=17/108), compared to 5.4% deaths from other causes (n=44/809). Deaths from eclampsia were less likely to involve a delay in patient/family reporting to the health facility[20] than deaths from other causes. Further factors associated with maternal death from eclampsia are shown in Figure 13.

[19] OR for lack of essential obstetric drugs for eclampsia deaths compared to deaths from other causes = OR 4.66 (2.41;8.82)
[20] OR for delay in reporting to facility for eclampsia deaths compared to deaths from other causes = OR 0.62 (0.4;0.96)

CASE STUDIES: ECLAMPSIA

Eclampsia case 1: A woman reported in labour ward fully awake, complaining of lower abdominal pain and backache. After assessment she was admitted to the antenatal ward to await progress. A day later, she reported to labour ward in active phase at 8 cm dilatation. After 25 min, she delivered a live infant. After the delivery she convulsed, protein found to be 2+. Magnesium sulphate was given and O2 sats were 92% so the patient was put on O2 therapy. She was transferred to HDU in the postnatal ward. The clinician reviewed the patient, saw her gasping, and heard no heart rate. CPR was done, adrenaline was given, and patient was intubated and taken to ICU. 2 hours later the patient had a second cardiac arrest, CPR was done for 5mins before death was declared.

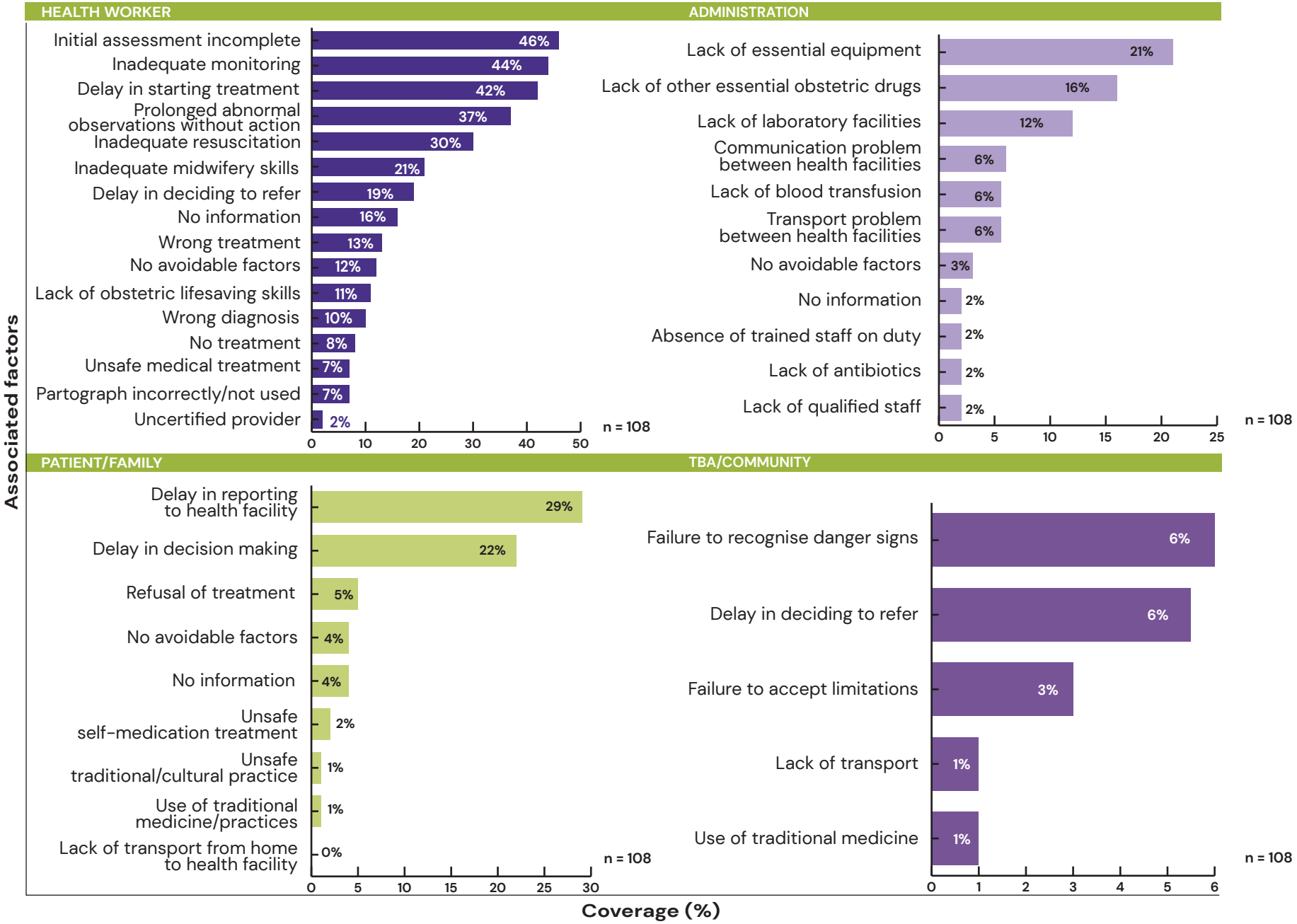
Eclampsia case 2: The patient was referred from a health centre due to a big fundus and pre-eclampsia with pre-labour rupture of membranes. On assessment, she had high BP and was initiated on antihypertensives. Ultrasound showed twin gestation; live fetuses at 33 weeks. Labour started spontaneously, and she delivered twins. Unfortunately, the patient was not systematically monitored. She then convulsed, lost consciousness, and became short of breath. There was no oxygen due to lack of cylinders, and she died.

RECOMMENDATIONS TO REDUCE DEATHS FROM ECLAMPSIA

In conjunction with wider recommendations, stakeholders agreed specific actions to reduce deaths from eclampsia:

1. Improve supply of magnesium sulphate
2. Ensure constant supply of good quality first and second line antihypertensives at all levels of the health care system.
3. Improve detection of hypertension by increasing the availability of functioning blood pressure machines (better supply of batteries or rechargeable devices) and urine dipsticks.

Figure 13. Factors associated with deaths from eclampsia



05. DISCUSSION

We found that the leading causes of maternal death in Malawi are maternal infection, postpartum haemorrhage, and eclampsia. Avoidable "Healthcare worker" factors were frequently linked with maternal deaths, particularly "inadequate monitoring", "inadequate resuscitation" and "delays in starting treatment".

5.1
CAUSES OF MATERNAL DEATH 2008-2023

We found that maternal infection, postpartum haemorrhage, and eclampsia were the main causes of maternal death from 2020-22. Due to changes in the classification system for maternal death it is difficult to compare our results to previous reports. It also must be kept in mind that comparison is only available for deaths occurring between 2008 and 2014 as there has been no national report providing analysis of deaths occurring between 2014 and 2020. From 2008-2012, the leading direct causes of death were pre-eclampsia/eclampsia (13.7% of deaths), postpartum sepsis (9.9%) and postpartum haemorrhage (7.6%). Leading indirect causes included anaemia (19.3%), malaria (15.3%) and HIV/AIDs (6.8%). The following report from 2012-2014 found postpartum sepsis (9.3%) to be the leading direct cause of death followed by pre-eclampsia/eclampsia (8.3%) and postpartum haemorrhage (6.4%). Leading indirect causes again included anaemia (12.5%), malaria (11.2%) and HIV/AIDS (15.0%). Table 12 combines different classifications of death to provide comparison with the current report.

Table 12. Standardised causes of death from 2008-2023

Cause of Death	2020-2023 (n=809) n (%)	2012-2014 (n=375) n (%)	2008-2012 (n=1103) n (%)
Maternal Infection	201 (24.8%)	100 (26.7%)	368 (33.4%)
Eclampsia/ pre-eclampsia	161 (19.9%)	31 (8.3%)	151 (13.7%)
Postpartum haemorrhage	165 (20.4%)	24 (6.4%)	84 (7.6%)

Since 2008, maternal infection has consistently been the leading cause of maternal death. During this time, the relative contribution of infections directly resulting from pregnancy appears to have remained stable (9.9% 2008-12, 9.3% 2012-14, 9.3% 2020-22) whilst the contribution of other infections has declined. The contribution of eclampsia/pre-eclampsia to maternal deaths appears to have increased over the 15-year interval. Postpartum haemorrhage as a cause of maternal death has increased dramatically when compared to earlier reports. This could reflect a true rate of increase in catastrophic postnatal bleeding. However, it may also reflect changes in classification systems; during review of maternal deaths for this report, the authors noted a tendency for deaths from PPH to be labelled as being caused by "anaemia" by MDSR committees, which we then reclassified as "PPH" in keeping with the classification system in use. It is possible that in previous reports, deaths from PPH were classified as being caused by "anaemia", either because the woman was in fact anaemic prior to bleeding, or because bleeding was felt to have caused catastrophic and acute anaemia. Therefore, there may not have been a true rise in PPH as a cause of maternal death.

Metanalysis of global data from 2003-2009 reported the leading causes of maternal death to be PPH (27.1% of all deaths), hypertensive disorders (14.0%) and maternal sepsis (10.7%).[12] It should be noted that this review was conducted prior to the WHO statement on maternal sepsis8, which broadened the definition of maternal sepsis to include infections not directly caused by pregnancy, and the contribution of "indirect" infections to maternal deaths is not clear from the published data.8 Taking this into account, whilst the causes of maternal death in Malawi are broadly comparable to global causes of maternal death, our findings suggest that hypertensive disorders contribute more frequently to maternal death in Malawi and PPH slightly less frequently when compared to global data. Detailed discussion of each leading cause of death is included in Section 4.0 of this report.

5.2 AVOIDABLE FACTORS ASSOCIATED WITH MATERNAL DEATHS

We found that "healthcare worker" factors, which were linked to 85% of maternal deaths by MDSR committees were the leading avoidable factor across all Zonal regions of Malawi. "Healthcare worker" factors include "inadequate monitoring", "inadequate resuscitation", "delay in starting treatment", "prolonged abnormal observations without action", and "lack of obstetric life-saving skills". These factors were also frequently linked to maternal deaths in previous reports with little improvement in the interim. This indicates that although Malawi has made strides in improving coverage of facility-based birth and has made investments in improving quality of care, getting to the facility may not in itself be enough. Although a leading factor in all three leading causes of death "healthcare worker" factors were more frequently and significantly associated with deaths from PPH compared to deaths from any other cause.

"Patient and family factors" such as delays in seeking care were involved in around half of all maternal deaths. The leading factor in this category remains similar across both reports, with "delay in reporting to health facility" a factor in 44.4% of deaths in 2012-14, and 38% of deaths in the current report. In the period of the current report, this was the most frequently assigned factor in deaths from maternal infection, the leading cause of maternal death.

"Administrative factors" such as lack of infrastructure and transport, resources such as drugs, blood products and essential obstetric medications were linked to almost half of all maternal deaths. This is unsurprising, and lack of resources in health facilities in low-income settings are often cited as a major determinant of ongoing high global maternal mortality ratios. However, we found improvement in administrative factors compared to previous reports. For example, in 2012-14, lack of blood transfusion was the most common administrative factor, associated with 20.5% of maternal deaths; in the current report this factor was involved in 11% of deaths.

A somewhat surprising finding of the current report was that only 4% of deaths from infection were associated with lack of antibiotics, whilst deaths from this cause were more often associated with "healthcare worker factors". This is perhaps an indicator that availability of resources may not be the strongest determinant of maternal death in this setting; We acknowledge that there is crossover between lack of resources and "healthcare worker" factors, and this must be considered when interpreting and applying our findings. For example, is monitoring inadequate because monitoring equipment is not available? Was there a delay in providing care because the theatre was occupied and there was no backup available? However, it must be considered that there is a gap between the knowledge and action of healthcare workers in the prevention and management of obstetric emergencies in this setting. The reasons for a potential "know-do gap" are likely complicated and multifaceted, but we must work to determine these reasons as they require our attention if Malawi's rates of maternal mortality are to be reduced.

5.3 STRENGTHS & LIMITATIONS OF REPORT

Our report is limited by the percentage of maternal deaths that have a completed MDA-2 form and are therefore suitable for inclusion in our analysis. Although around 70% of deaths were audited and therefore are included in the report, there are major gaps in completeness of audit at the facility level, particularly in the Northern zone (47 [32.4%] deaths audited) including Mzuzu Central hospital (11 [22.4%] deaths audited), and at Kamuzu Central Hospital (94 [43.5%] deaths audited). Lack of data from an entire zone and from two central hospitals weakens of our findings in both accuracy and generalisability.

A further weakness lies in the possibility that there are maternal deaths which occur in the community without being reported to the health system, unaccounted for in total numbers of maternal deaths estimated from MDA-1 forms, and which are not eligible for review at facility level and therefore cannot be included in our analysis. Attempts have been made to incorporate births and deaths occurring outside of the health facility setting in the MatSurvey reporting platform (since 2021), but it as yet unknown how successful this has been. As we are unable to rely on numbers of live births occurring outside of the district facility setting, MMRs calculated must be read as only referring to a particular district level facility (or facilities within a zone) rather than being representative of all births and deaths in a geographical area. As with previous reports, data from the island of Likoma (composed of 2 facilities) is not available.

A limitation of our data includes lack of a "control" group; we do not have access to robust data for women living through pregnancy, birth and the postnatal period in Malawi with which to compare those who died in order to better determine risk factors for maternal death.

It is possible that deaths resulting from induced abortions are underreported in our analysis. Induced abortion remains illegal in Malawi, punishable by 14 years

imprisonment. However, with high rates of unintended pregnancy, induced abortions occur frequently, under unsafe conditions.13 A total of 52 deaths occurred due to abortion/miscarriage (including both infectious and non-infectious complications). In 14 (27.0%) cases there was significant evidence that the abortion had been induced, either due to documented disclosure by the woman or her relatives, or due to the medical circumstances of the case. Our data therefore suggests that around a quarter of abortion-related deaths resulted from unsafe induced abortion during the period of this report. However, it is likely that this is an underestimation of deaths related to induced abortion; firstly, no specific data collection method currently exists to differentiate deaths from spontaneous versus induced abortions, and secondly because cultural, religious and legal barriers are likely to inhibit women from seeking post-abortion care at healthcare facilities in cases of induced abortion, as well as inhibiting disclosure of their pregnancies or of the nature of their abortion to either healthcare professionals or to their relatives. It is possible that women in this situation may die without ever disclosing their pregnancy, and therefore would not be counted in numbers of maternal deaths.

This report is strengthened by a robust system of digital data collection, review of data quality, and regular follow-up by members of the MLW MatSurvey team and MOH (Zonal Safe Motherhood/Maternal & Newborn Health Coordinators) as well as by training and mentoring stakeholders, members of District Health Management Teams, Zonal and Safe Motherhood Coordinators in effective utilisation of the MatSurvey platform, including public dashboard for real time review of data by MOH staff at Zonal, central and district levels. Determination of the cause of each maternal death was strengthened by an additional review of each case to verify or refute the assigned cause of death by an obstetric practitioner, with the assistance of a second obstetrician where cases were unclear. A further strength of this report is the robust process used to produce recommendations based on the results of our analysis. We gathered stakeholders over two days to produce a long list of recommendations based on the findings outlined herein. This long list was then narrowed down by a small working group of individuals from the NCCEMD.

06.
RECOMMENDATIONS

Recommendations based on the findings of this report were formulated by stakeholders from all levels of the health system and partner organisations (see Section 2.5, 2.6 and Appendix 10). They are intended to be used by policy makers, implementors and funding organisations to effectively reduce maternal mortality in Malawi. A description of how recommendations were formulated is included in Appendix 11.

Key policy areas where action is needed to reduce maternal deaths:
Stakeholders agree that action is urgently needed in the following areas to prevent maternal deaths:

- *Improving the referral and admission process*
- *Reducing deaths following Caesarean section*
- *Tackling the leading causes of maternal death*
- *Addressing healthcare worker factors involved in maternal deaths*
- *Improving health-seeking behaviour at a community level*

6.1 IMPROVING THE REFERRAL AND ADMISSION PROCESS

Analysis shows that a high number of women are dying following referral, and that improvements can be made by both referring and receiving facilities to tackle this problem.

Stakeholders recommended that is necessary to:

1. **Develop standardised referral guidelines** – detailing criteria for referral and outlining the referral process. This should include who or what conditions should be referred, what pre-referral care should be administered, a standardised transfer checklist and admission assessment form (see below), and should outline what communication is necessary between facilities before referral.
2. **Develop and implement a pre-transfer checklist for patients being referred to another facility.** The aim of this is to act as a prompt and a record of care to ensure that all required medications are given, and vital signs are checked and recorded up until the point of transfer. This should ideally include use of an "early warning score" system. It will also document discussion with the receiving facility. The checklist should be signed by the responsible professional from the referring facility. Checklists should be developed relevant to obstetric emergencies, e.g. was magnesium sulphate given in a case of eclampsia? The checklist should travel with the patient.
3. **Develop and implement a standardised admission assessment form** for use at receiving facilities. Assessment forms should include space for patient vital signs and use an "early warning score" system to triage patients and alert staff to women who need medical attention on arrival.
4. **Establish an obstetric critical care pathway and improve intensive care capacity** for use at district and tertiary hospital level.

6.2 REDUCING DEATHS FOLLOWING CAESAREAN SECTION

We found that over 50% of maternal deaths occur after Caesarean section, despite an overall CS rate of <10% nationally.

Stakeholders recommended that it is necessary to:

1. **Ensure the use of a surgical safety checklist specific to Caesarean section across all facilities offering the procedure.** Using a checklist prior to surgery would ensure anticipation of and preparedness for obstetric emergencies and would encourage rigorous infection prevention measures are adhered to. For example, a checklist would identify a patient at high risk of bleeding due to multiparity and low haemoglobin, the theatre team can then ensure the availability and administration of uterotonic drugs and blood products in anticipation of an emergency. The checklist should be accompanied by a peri-operative pro forma for documenting patient care notes for women undergoing CS including operation notes and anaesthetic documentation. Funding should be sought to enable printing of checklists/pro formas for use for each patient. Protocols for safe obstetric anaesthesia and care of the peri-operative obstetric patient should be developed and implemented alongside the use of a checklist. A checklist specific to CS is currently in use at QECH and one has been developed for district/community hospital. These should be combined for all hospital settings and rolled out nationally. This will require funding to be allocated for sustainable provision of stationary.
2. **Adopt and implement a national policy of vaginal cleansing prior to every Caesarean section** as this has been proven in systematic review evidence to reduce infection, is recommended by the WHO and does not require additional resources.
3. **Develop and implement a postnatal care booklet to improve the monitoring of post-operative obstetric patients.** This would prompt regular vital signs and examination and encourage early identification and action on danger signs. Stakeholders noted that this will require an increase in the number of staff available to monitor postnatal patients and funding allocated for sustainable provision of stationary.
4. **Improve the quality of CS surgery by improving training.** Ensure medical students and clinical officer students are trained at facilities which have been certified by the Medical Council of Malawi as providing a high quality of training and supervision. Introduce competency-based sign-off for those who are responsible for performing CS.
5. **Improve resource availability for safe CS surgery** by ensuring adequate supply of antiseptics, linen, drugs (particularly tranexamic acid, oxytocin, IV fluids, antibiotics) and blood products.

6.3
TACKLING THE LEADING CAUSES OF MATERNAL DEATH: INFECTION

Stakeholders agreed specific actions required to reduce deaths from infection:

1. **Provide education to pregnant women about the risks of infection and how to prevent and recognise infection.** This should include advice to bathe prior to admission, need for clean sanitary pads/coths before and after birth, and danger signs to look out for. This could be delivered through health service assistants (HSAs), community midwife assistants, antenatal clinic midwives, and community leaders.
2. **Strengthen infection prevention and control (IPC) practices amongst HCWs through:**
   a. **Improving resources for sterile vaginal examination** including antiseptic, sterile gloves, gauze, and sterile field.
   b. **Adopting a protocol of vaginal preparation prior to CS for all women at all facilities** (see above)
   c. **Improving monitoring of IPC practices** through regular audit, presentation of findings to HCWs, and re-audit to demonstrate whether improvement has been achieved.
3. **Improve availability of newer generations of antibiotics** such as carbapenems, fourth generation penicillins or cepahlosporins **and improve targeted antibiotic therapy** by improving capacity for culture and resistance profiling of organisms.

6.4
TACKLING THE LEADING CAUSES OF MATERNAL DEATH: POST-PARTUM HAEMORRHAGE

Stakeholders agreed specific actions to reduce deaths from post-partum haemorrhage:

1. **Engage with communities to discourage harmful traditional practices** such as the use of traditional medicines to stimulate uterine contractions to induce abortion, induce labour or enhance contractions ("local pitocin"). This includes those known in local areas as kachipande, mwanaphepo, kholowa, chewe, katinti, boiled or smoked cow dung, misisi ya kankhande (thelele la achewa), kanyani, ma oranges, roots of mpoza tree, masamba amasawu, lupusu/luputsu, nandolo leaves, kutikita pamimba.
2. **Improve early detection and treatment of anaemia** through increased availability of full blood count testing and haematinics and ensure community awareness regarding diet to prevent anaemia in pregnancy.
3. **Ensure supply of and training of staff in the use of tranexamic acid** to prevent and manage bleeding. Add to essential drug list.

6.5
TACKLING THE LEADING CAUSES OF MATERNAL DEATH: ECLAMPSIA

Stakeholders agreed specific actions to reduce deaths from eclampsia:

1. **Improve detection of hypertension and proteinuria** antenatally by increasing the availability of functioning blood pressure machines (better supply of batteries or rechargeable devices) and urine dipsticks.
2. **Improve management of antenatal hypertension** by ensuring availability of medications and treatment protocols, particularly for mild/moderate hypertension to prevent disease progression and complications.
3. **Ensure constant supply of good quality first and second line antihypertensives** at all levels of the health care system.
4. **Improve supply of treatment for acute severe hypertension/pre-eclampsia** including magnesium sulphate and anti-hypertensives.

6.6
ADDRESSING HEALTHCARE WORK FACTORS ASSOCIATED WITH MATERNAL DEATHS

Avoidable healthcare worker (HCW) factors were associated with 85% of maternal deaths. Stakeholders agreed that it is necessary to:

1. **Improve supervision and mentorship of HCWs by ensuring robust supervision.** Ensure those conducting supervision have appropriate experience and technical expertise, and that each supervision builds on the previous. Reduce off-site training for management-level HCWs so that they can be present at facilities to supervise and mentor staff.
2. **Improve performance of HCWS by:**
   a. **Auditing practice, sharing results with staff and re-auditing** to detect improvement in practice.
   b. **Carrying out quarterly skills drills in management of obstetric emergencies** at all levels of facilities. Ensure staff rotation does not disrupt the provision of skills drills training.
   c. **Ensuring CPD undertaken for re-registration is relevant to HCW job role** and have mandatory topics based on facility-specific needs, informed by the results of audits.
3. **Improve working conditions and motivation of HCWs to improve performance by**
   a. Ensuring adequate supply of resources for optimal patient care
   b. Renumerating fairly/increasing pay
   c. Reinforcing non-monetary rewards to best-performing HCWs.

6.7 IMPROVING HEALTH-SEEKING BEHAVIOUR AT A COMMUNITY LEVEL

We found that delays in a patient or her family reporting to a health facility were a factor in around 40% of maternal deaths in Malawi. Stakeholders agreed that it is necessary to:

1. **Translate into lay language, and share data from this report** with community leaders.
2. **Encourage male involvement in antenatal care** by making the first antenatal contact meaningful for men.
3. **Encourage families to have birth preparedness plans** that include emergency scenarios.
4. **Strengthen antenatal care to provide more information about danger signs** and how and when to seek help.
5. **Develop a feedback mechanism for service users** (e.g. an anonymous phone line).

07.
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7.1 REFERENCES

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08. APPENDICES

APPENDIX 1.
LIST OF ZONAL REGIONS AND CORRESPONDING HOSPITAL FACILITIES

Table 13. List of zonal regions and corresponding hospital facilities

REGION	FACILITIES
NORTH	Chitipa District Hospital Karonga District Hospital Likoma District Hospital Mzimba South District Hospital Mzuzu Central District Hospital Nkhata Bay District Hospital Rumphi District Hospital
CENTRAL EAST	Dowa Kasungu Nkhotakota Ntchisi Salima
CENTRAL WEST	Bwaila Dedza Kamuzu Mchinji Ntcheu
SOUTH EAST	Balaka District Hospital Machinga Mangochi Mulanje Phalombe Zomba
SOUTH WEST	Chikwawa Chiradzulu Mwanza Neno Nsanje Queen Elizabeth Central Hospital Thyolo

APPENDIX 2.
CLASSIFICATION OF MATERNAL DEATHS USED IN THIS REPORT

Minor changes have been made to the grouping of maternal deaths for ease of use in this report (see section 2.3 for details).

Table 14. Classification system for grouping and determining cause of maternal deaths

Level 1: Group	Level 2: Causes
Abortion-related complications	Abortion/miscarriage Ectopic pregnancy Molar pregnancy
Hypertensive disorders in pregnancy	Pre-eclampsia Eclampsia
Obstetric haemorrhage	Antepartum haemorrhage Intrapartum haemorrhage Postpartum haemorrhage
Ruptured uterus	Ruptured uterus
Maternal infection	Pregnancy-related infection[21] Other infections[22]
Other obstetric complications	Hyperemesis gravidarum with metabolic disturbance Venous complications in pregnancy Diabetes mellitus in pregnancy Liver disorders in pregnancy Obstetric embolism (Amniotic embolism) Peripartum Cardiomyopathy
Non-obstetric complications	Cardiac disease (including pre-existing hypertension) GI Tract Central nervous system conditions Respiratory conditions Genitourinary conditions Autoimmune disorders Skeletal diseases Psychiatric disorders Cancer Anaemia Haematological
Complications of anaesthesia	Complications of anaesthesia
Coincidental causes	Coincidental causes
Undetermined	Undetermined

APPENDIX 3.
MATERNAL DEATHS BY GROUP & ZONE

Table 15. Maternal deaths by group and zone

	Total (n=809) n (%)	**North** (n=47) n (%)	**Central East** (n=162) n (%)	**Central West** (n=175) n (%)	**South East** (n=212) n (%)	**South West** (n=213) n (%)
Obstetric haemorrhage	204 (25.2%)	11 (23.4%)	43 (26.5%)	31 (17.7%)	67 (31.6%)	52 (24.4%)
Maternal Infection	201 (24.8%)	12 (25.5%)	32 (19.8%)	46 (26.3%)	41 (19.3%)	70 (32.9%)
Hypertensive disorders	161 (19.9%)	8 (17.0%)	36 (22.2%)	43 (24.6%)	31 (14.6%)	43 (20.2%)
Undetermined	71 (8.8%)	4 (8.5%)	7 (4.3%)	22 (12.6%)	30 (14.2%)	8 (3.8%)
Ruptured Uterus	68 (8.4%)	4 (8.5%)	19 (11.7%)	8 (4.6%)	23 (10.8%)	14 (6.6%)
Abortion-related complications	65 (8.0%)	4 (8.5%)	16 (9.9%)	10 (5.7%)	13 (6.1%)	22 (10.3%)
Non-obstetric complications	26	1	6	5	5	9
Other obstetric complications	24 (3.0%)	3 (6.4%)	3 (1.9%)	9 (5.1%)	5 (2.4%)	4 (1.9%)
Complications of anaesthesia	10 (1.2%)	0 (0.0%)	2 (1.2%)	5 (2.9%)	1 (0.5%)	2 (0.9%)
Coincidental causes	2 (0.2%)	1 (2.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)

APPENDIX 4.
MATERNAL DEATHS BY CAUSE & ZONE

Table 16. Maternal deaths by cause and zone

	Total (n=809) n (%)	North (n=47) n (%)	Central East (n=162) n (%)	Central West (n=175) n (%)	South East (n=212) n (%)	South West (n=213) n (%)
Maternal Infection	201 (24.8%)	12 (25.5%)	32 (19.8%)	46 (26.3%)	41 (19.3%)	70 (32.9%)
Postpartum haemorrhage	165 (20.4%)	8 (17.0%)	34 (21.0%)	26 (14.9%)	54 (25.5%)	43 (20.2%)
Eclampsia	108 (13.3%)	8 (17.0%)	24 (14.8%)	22 (12.6%)	25 (11.8%)	29 (13.6%)
Undetermined	71 (8.8%)	4 (8.5%)	7 (4.3%)	22 (12.6%)	30 (14.2%)	8 (3.8%)
Ruptured uterus	68 (8.4%)	4 (8.5%)	19 (11.7%)	8 (4.6%)	23 (10.8%)	14 (6.6%)
Pre-eclampsia	53 (6.6%)	0 (0.0%)	12 (7.4%)	21 (12.0%)	6 (2.8%)	14 (6.6%)
Antepartum haemorrhage	39 (4.8%)	3 (6.4%)	9 (5.6%)	5 (2.9%)	13 (6.1%)	9 (4.2%)
Abortion/ miscarriage	29 (3.6%)	1 (2.1%)	13 (8.0%)	4 (2.3%)	6 (2.8%)	5 (2.3%)
Peripartum Cardiomyopathy	11 (1.4%)	2 (4.3%)	1 (0.6%)	6 (3.4%)	1 (0.5%)	1 (0.5%)
Complications of anaesthesia	10 (1.2%)	0 (0.0%)	2 (1.2%)	5 (2.9%)	1 (0.5%)	2 (0.9%)
Ectopic pregnancy	9 (1.1%)	2 (4.3%)	0 (0.0%)	0 (0.0%)	3 (1.4%)	4 (1.9%)
Respiratory conditions	9 (1.1%)	0 (0.0%)	3 (1.9%)	1 (0.6%)	1 (0.5%)	4 (1.9%)
Venous complications in pregnancy	8 (1.0%)	0 (0.0%)	1 (0.6%)	3 (1.7%)	2 (0.9%)	2 (0.9%)
Cardiac disease	5 (0.6%)	0 (0.0%)	0 (0.0%)	3 (1.7%)	2 (0.9%)	0 (0.0%)
Molar pregnancy	4 (0.5%)	0 (0.0%)	1 (0.6%)	2 (1.1%)	0 (0.0%)	1 (0.5%)
GI Tract	4 (0.5%)	0 (0.0%)	1 (0.6%)	1 (0.6%)	0 (0.0%)	2 (0.9%)
Cancer	3 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)	2 (0.9%)
Anaemia	2 (0.2%)	0 (0.0%)	1 (0.6%)	0 (0.0%)	0 (0.0%)	1 (0.5%)
Hyperemesis Gravidarum	2 (0.2%)	0 (0.0%)	1 (0.6%)	0 (0.0%)	1 (0.5%)	0 (0.0%)
Diabetes	2 (0.25%)	1 (2.1%)	0 (0.0%)	0 (0.0%)	1 (0.5%)	0 (0.0%)
Coincidental causes	2 (0.2%)	1 (2.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)
CNS conditions	1 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)	0 (0.0%)
Haematological	1 (0.1%)	0 (0.0%)	1 (0.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Amniotic embolism	1 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)
Psychiatric disorders	1 (0.1%)	1 (2.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

APPENDIX 5.
LEADING CAUSE OF MATERNAL DEATH BY FACILITY

Table 17. Leading cause of maternal death by facility

	Total (n=809) n (%)	Infections n (%)	PPH n (%)	Eclampsia n (%)	Other n (%)
Balaka	22 (2.7%)	4 (18.2%)	5 (22.7%)	2 (9.1%)	11 (50%)
Blantyre DHO	1 (0.1%)	0 (0.0%)	1 (100%)	0 (0.0%)	0 (0.0%)
Bwaila	3 (0.4%)	0 (0.0%)	3 (100%)	0 (0.0%)	0 (0.0%)
Chikwawa	40 (4.9%)	4 (10%)	13 (32.5%)	10 (25.0%)	13 (32.5%)
Chiradzulu	22 (2.7%)	5 (22.7%)	3 (13.6%)	2 (9%)	12 (54.5%)
Chitipa	7 (0.9%)	3 (42.9%)	0 (0.0%)	2 (28.6%)	2 (28.6%)
Dedza	19 (2.3%)	3 (15.8%)	5 (26.3%)	4 (21%)	7 (36.8%)
Dowa	20 (2.5%)	2 (10%)	3 (15%)	2 (10%)	13 (65%)
Karonga	9 (1.1%)	1 (11.1%)	0 (0.0%)	3 (33.3%)	5 (55.6%)
Kasungu	44 (5.4%)	10 (22.7%)	12 (27.2%)	5 (11.3%)	17 (38.6%)
KCH	94 (11.6%)	29 (30.9%)	8 (8.5%)	13 (13.8%)	44 (46.8%)
Machinga	60 (7.4%)	10 (16.6%)	19 (31.7%)	4 (6.7%)	27 (45%)
Mangochi	35 (4.3%)	4 (11.4%)	9 (25.7%)	5 (14.3%)	17 (48.6%)
Mchinji	25 (3.1%)	3 (12%)	4 (16%)	2 (8%)	16 (64%)
Mulanje	22 (2.7%)	3 (13.6%)	4 (18.2%)	6 (27.3%)	9 (40.9%)
Mwanza	8 (1.0%)	2 (25%)	3 (37.5%)	0 (0.0%)	3 (37.5%)
Mzimba North	6 (0.7%)	2 (33.3%)	1 (16.6%)	0 (0.0%)	3 (50%)
Mzuzu Central	11 (1.4%)	3 (27.3%)	2 (18.2%)	1 (9.1%)	5 (25.3%)
Neno	3 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (100%)
Nkhata Bay	12 (1.5%)	2 (16.7%)	4 (33.3%)	2 (16.7%)	4 (33.3%)
Nkhotakota	44 (5.4%)	10 (22.7%)	9 (20.5%)	12 (27.3%)	13 (29.5%)
Nsanje	16 (2.0%)	3 (18.8%)	5 (31.3%)	2 (12.5%)	6 (37.5%)
Ntcheu	34 (4.2%)	11 (32.4%)	6 (17.6%)	3 (8.8%)	14 (41.2%)
Ntchisi	16 (2.0%)	4 (25.0%)	4 (25.0%)	2 (12.5%)	6 (37.5%)
Phalombe	23 (2.8%)	4 (17.4%)	11 (47.8%)	2 (8.7%)	6 (26.1%)
QECH	107 (13.2%)	54 (50.5%)	12 (11.2%)	11 (10.3%)	30 (28%)
Rumphi	2 (0.2%)	1 (50%)	1 (50%)	0 (0.0%)	0 (0.0%)
Salima	38 (4.7%)	6 (15.8%)	6 (15.8%)	3 (7.9%)	23 (60.5%)
Thyolo	16 (2.0%)	2 (12.5%)	6 (37.5%)	4 (33.3%)	4 (33.3%)
Zomba Central	40 (4.9%)	14 (35%)	4 (10%)	4 (10%)	18 (45%)
Zomba DHO	10 (1.2%)	2 (20%)	2 (20%)	2 (20%)	4 (40%)

Table 18. Relative contribution of each facility to leading causes of maternal death

	Total (n=809) n (%)	Infections n (%)	PPH n (%)	Eclampsia n (%)	Other n (%)
Balaka	22 (2.7%)	4 (2.0%)	5 (3.0%)	2 (1.9%)	11 (3.3%)
Blantyre DHO	1 (0.1%)	0 (0.0%)	1 (0.6%)	0 (0.0%)	0 (0.0%)
Bwaila	3 (0.4%)	0 (0.0%)	3 (1.8%)	0 (0.0%)	0 (0.0%)
Chikwawa	40 (4.9%)	4 (2.0%)	13 (7.9%)	10 (9.3%)	13 (3.9%)
Chiradzulu	22 (2.7%)	5 (2.5%)	3 (1.8%)	2 (1.9%)	12 (3.6%)
Chitipa	7 (0.9%)	3 (1.5%)	0 (0.0%)	2 (1.9%)	2 (0.6%)
Dedza	19 (2.3%)	3 (15.8%)	5 (3.0%)	4 (3.7%)	7 (2.1%)
Dowa	20 (2.5%)	2 (1.0%)	3 (1.8%)	2 (1.9%)	13 (3.9%)
Karonga	9 (1.1%)	1 (0.5%)	0 (0.0%)	3 (2.8%)	5 (1.5%)
Kasungu	44 (5.4%)	10 (5.0%)	12 (7.3%)	5 (4.6%)	17 (5.1%)
KCH	94 (11.6%)	29 (14.4%)	8 (4.8%)	13 (12.0%)	44 (13.1%)
Machinga	60 (7.4%)	10 (5.0%)	19 (11.5%)	4 (3.7%)	27 (8.1%)
Mangochi	35 (4.3%)	4 (2.0%)	9 (5.5%)	5 (4.6%)	17 (5.1%)
Mchinji	25 (3.1%)	3 (1.5%)	4 (2.4%)	2 (1.9%)	16 (4.8%)
Mulanje	22 (2.7%)	3 (1.5%)	4 (2.4%)	6 (5.6%)	9 (2.7%)
Mwanza	8 (1.0%)	2 (1.0%)	3 (1.8%)	0 (0.0%)	3 (0.9%)
Mzimba North	6 (0.7%)	2 (1.0%)	1 (0.6%)	0 (0.0%)	3 (0.9%)
Mzuzu Central	11 (1.4%)	3 (1.5%)	2 (1.2%)	1 (0.9%)	5 (1.5%)
Neno	3 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (0.9%)
Nkhata Bay	12 (1.5%)	2 (1.0%)	4 (2.4%)	2 (1.9%)	4 (1.2%)
Nkhotakota	44 (5.4%)	10 (5.0%)	9 (5.5%)	12 (11.1%)	13 (3.9%)
Nsanje	16 (2.0%)	3 (1.5%)	5 (3.0%)	2 (1.9%)	6 (1.8%)
Ntcheu	34 (4.2%)	11 (5.5%)	6 (3.6%)	3 (2.8%)	14 (4.2%)
Ntchisi	16 (2.0%)	4 (2.0%)	4 (2.4%)	2 (1.9%)	6 (1.8%)
Phalombe	23 (2.8%)	4 (2.0%)	11 (6.7%)	2 (1.9%)	6 (1.8%)
QECH	107 (13.2%)	54 (26.9%)	12 (7.3%)	11 (10.2%)	30 (9.0%)
Rumphi	2 (0.2%)	1 (0.5%)	1 (0.6%)	0 (0.0%)	0 (0.0%)
Salima	38 (4.7%)	6 (3.0%)	6 (3.6%)	3 (2.8%)	23 (6.9%)
Thyolo	16 (2.0%)	2 (1.0%)	6 (3.6%)	4 (3.7%)	4 (1.2%)
Zomba Central	40 (4.9%)	14 (7.0%)	4 (2.4%)	4 (3.7%)	18 (5.4%)
Zomba DHO	10 (1.2%)	2 (1.0%)	2 (1.2%)	2 (1.9%)	4 (1.2%)

APPENDIX 6.
UNAMENDED CLASSIFICATION OF MATERNAL DEATHS

Table 19 outlines the original classification system (adapted from WHO ICD-10-MM) previously developed for use in Malawi. This has been altered slightly for use in this report (see section 2.3 and Appendix 2 for details). Groups and causes of death corresponding to the classification system outlined below are found in Appendices 7 and 8.

Table 19. Original classification system for grouping and determining cause of maternal deaths

Level 1 Group	Level 2 Causes
Abortion-related complications	Abortion/miscarriage
	Ectopic pregnancy
	Molar pregnancy
	Septic miscarriage
Hypertensive disorders in pregnancy	Pre-eclampsia
	Eclampsia
Obstetric haemorrhage	Antepartum haemorrhage
	Intrapartum haemorrhage
	Postpartum haemorrhage
Ruptured uterus	Ruptured uterus
Pregnancy-related infection	Infection of genitourinary tract
	Infection of amniotic sac and membranes
	Other infection during pregnancy and labour
Other obstetric complications	Hyperemesis gravidarum with metabolic disturbance
	Venous complications in pregnancy
	Diabetes mellitus in pregnancy
	Liver disorders in pregnancy
	Obstetric embolism (Amniotic embolism)
	Peripartum Cardiomyopathy
Non-obstetric complications	Cardiac disease (including pre-existing hypertension)
	GI Tract
	Central nervous system conditions
	Respiratory conditions
	Genitourinary conditions
	Autoimmune disorders
	Skeletal diseases
	Psychiatric disorders
	Neoplasms
	Infections that are not a direct result of pregnancy
	HIV/AIDS
	Cancer
	COVID-19
	Anaemia
	Haematological
Complications of anaesthesia	Complications of anaesthesia
Coincidental causes	Coincidental causes
Undetermined	Undetermined

APPENDIX 7.
MATERNAL DEATHS BY GROUP AND ZONE (UNAMENDED CLASSIFICATION)

Table 20. Maternal deaths by group and zone (unamended)

	Total (n=809) n (%)	North (n=47) n (%)	Central East (n=162) n (%)	Central West (n=175) n (%)	South East (n=212) n (%)	South West (n=213) n (%)
Obstetric haemorrhage	204 (25.2%)	11 (23.4%)	43 (26.5%)	31 (17.7%)	67 (31.6%)	52 (24.4%)
Hypertensive disorders	161 (19.9%)	8 (17.0%)	36 (22.2%)	43 (24.6%)	31 (14.6%)	43 (20.2%)
Non-obstetric complications	129 (15.9%)	7 (14.9%)	26 (16.0%)	26 (14.9%)	26 (12.3%)	44 (20.7%)
Pregnancy-related infection	75 (9.3%)	5 (10.6%)	10 (6.2%)	21 (12.0%)	16 (7.5%)	23 (10.8%)
Unknown	71 (8.8%)	4 (8.5%)	7 (4.3%)	22 (12.6%)	30 (14.2%)	8 (3.8%)
Ruptured Uterus	68 (8.4%)	4 (8.5%)	19 (11.7%)	8 (4.6%)	23 (10.8%)	14 (6.6%)
Abortion related complications	65 (8.0%)	4 (8.5%)	16 (9.9%)	10 (5.7%)	13 (6.1%)	22 (10.3%)
Other obstetric complications	24 (3.0%)	3 (6.4%)	3 (1.9%)	9 (5.1%)	5 (2.4%)	4 (1.9%)
Complications of anaesthesia	10 (1.2%)	0 (0.0%)	2 (1.2%)	5 (2.9%)	1 (0.5%)	2 (0.9%)
Coincidental causes	2 (0.2%)	1 (2.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)

APPENDIX 8.
MATERNAL DEATHS BY CAUSE AND ZONE (UNAMENDED CLASSIFICATION)

Table 21 gives maternal deaths by cause and zone according to the unamended classification system. Causes with no maternal deaths attributed to them are excluded from the table.

Table 21. Maternal deaths by cause and zone (unamended)

	Total (n=809) n (%)	**North** (n=47) n (%)	**Central East** (n=162) n (%)	**Central West** (n=175) n (%)	**South East** (n=212) n (%)	**South West** (n=213) n (%)
Postpartum haemorrhage	165 (20.4%)	8 (17.0%)	34 (21.0%)	26 (14.9%)	54 (25.5%)	43 (20.2%)
Eclampsia	108 (13.3%)	8 (17.0%)	24 (14.8%)	22 (12.3%)	25 (11.8%)	29 (13.6%)
Infections not a direct result of pregnancy	103 (12.7%)	6 (12.8%)	20 (12.3%)	21 (12.0%)	21 (9.9%)	35 (16.4%)
Pregnancy-related infection	75 (9.3%)	5 (10.6%)	10 (6.2%)	21 (12.0%)	16 (7.5%)	23 (10.8%)
Undetermined	71 (8.8%)	4 (8.5%)	7 (4.3%)	22 (12.6%)	30 (14.2%)	8 (3.8%)
Ruptured uterus	68 (8.4%)	4 (8.5%)	19 (11.7%)	8 (4.6%)	23 (10.8%)	14 (6.6%)
Pre-eclampsia	53 (6.6%)	0 (0.0%)	12 (7.4%)	21 (12.0%)	6 (2.8%)	14 (6.6%)
Antepartum haemorrhage	39 (4.8%)	3 (6.4%)	9 (5.6%)	5 (2.9%)	13 (6.1%)	9 (4.2%)
Abortion/ miscarriage	52 (6.4%)	2 (4.3%)	15 (9.3%)	8 (4.6%)	10 (4.7%)	17 (8.0%)
Complications of anaesthesia	10 (1.2%)	0 (0.0%)	2 (1.2%)	5 (2.9%)	1 (0.5%)	2 (0.9%)
Ectopic pregnancy	9 (1.1%)	2 (4.3%)	0 (0.0%)	0 (0.0%)	3 (1.4%)	4 (1.9%)
Respiratory conditions	9 (1.1%)	0 (0.0%)	3 (1.9%)	1 (0.6%)	1 (0.5%)	4 (1.9%)
Venous complications in pregnancy	8 (1.0%)	0 (0.0%)	1 (0.6%)	3 (1.7%)	2 (0.9%)	2 (0.9%)
Cardiac disease	16 (2.0%)	2 (4.3%)	1 (0.6%)	6 (3.4%)	1 (0.5%)	1 (0.5%)
Molar pregnancy	4 (0.5%)	0 (0.0%)	1 (0.6%)	2 (1.1%)	0 (0.0%)	1 (0.5%)
GI Tract	4 (0.5%)	0 (0.0%)	1 (0.6%)	1 (0.6%)	0 (0.0%)	2 (0.9%)
Cancer	3 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)	2 (0.9%)
Anaemia	2 (0.2%)	0 (0.0%)	1 (0.6%)	0 (0.0%)	0 (0.0%)	1 (0.5%)
Hyperemesis Gravidarum	2 (0.2%)	0 (0.0%)	1 (0.6%)	0 (0.0%)	1 (0.5%)	0 (0.0%)
Diabetes	2 (0.25%)	1 (2.1%)	0 (0.0%)	0 (0.0%)	1 (0.5%)	0 (0.0%)
Coincidental causes	2 (0.2%)	1 (2.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)
CNS conditions	1 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)	0 (0.0%)
Haematological	1 (0.1%)	0 (0.0%)	1 (0.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Amniotic embolism	1 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.5%)
Psychiatric disorders	1 (0.1%)	1 (2.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

APPENDIX 9.
FACTORS ASSOCIATED WITH MATERNAL DEATHS BY ZONE

Table 22. Factors associated with maternal deaths by zone

Associated Factor	Total (n=809) n (%)	North (n=47) n (%)	Central East (n=162) n (%)	Central West (n=175) n (%)	South East (n=212) n (%)	South West (n=213) n (%)
Healthcare worker factors						
Any healthcare worker factor	688 (85.0%)	43 (91.5)	145 (89.5%)	143 (81.7%)	178 (84.0%)	179 (84.0%)
Inadequate midwifery skills	173 (21.4%)	15 (31.9%)	35 (21.6%)	40 (22.9%)	38 (17.9%)	45 (21.1%)
Uncertified provider	5 (0.6%)	1 (2.1%)	1 (0.6%)	0 (0.0%)	0 (0.0%)	3 (1.4%)
Delay in deciding to refer	172 (21.3%)	9 (19.1%)	29 (17.9%)	40 (22.9%)	44 (20.8%)	50 (23.5%)
Initial assessment incomplete	319 (39.4%)	23 (48.9%)	75 (46.3%)	65 (37.1%)	79 (37.3%)	77 (36.2%)
Inadequate resuscitation	327 (40.4%)	22 (46.8%)	77 (47.5%)	69 (39.4%)	75 (35.4%)	84 (39.4%)
Wrong diagnosis	99 (12.2%)	3 (6.4%)	23 (14.2%)	22 (12.6%)	16 (7.5%)	35 (16.4%)
Partograph incorrectly/not used	73 (9.0%)	0 (0.0%)	19 (11.7%)	17 (9.7%)	19 (9.0%)	18 (8.5%)
Wrong treatment	98 (12.1%)	4 (8.5%)	19 (11.7%)	26 (14.9%)	13 (6.1%)	36 (16.9%)
Unsafe medical treatment	36 (4.4%)	1 (2.1%)	7 (4.3%)	14 (8.0%)	3 (1.4%)	11 (5.2%)
No treatment	47 (5.8%)	5 (10.6%)	14 (8.6%)	14 (8.0%)	8 (3.8%)	6 (2.8%)
Delay in starting treatment	321 (39.7%)	19 (40.4%)	58 (35.8%)	78 (44.6%)	71 (33.5%)	95 (44.6%)
Inadequate monitoring	347 (42.9%)	18 (38.3%)	75 (46.3%)	75 (42.9%)	88 (41.5%)	91 (42.7%)
Prolonged abnormal observations without	276 (34.1%)	15 (31.9%)	53 (32.7%)	72 (41.1%)	61 (28.8%)	75 (35.2%)
Lack of obstetric lifesaving skills	109 (13.5%)	6 (12.8%)	13 (8.0%)	26 (14.9%)	31 (14.6%)	33 (15.5%)
Delay in deciding to refer	172 (21.3%)	9 (19.1%)	29 (17.9%)	40 (22.9%)	44 (20.8%)	50 (23.5%)

FACTORS ASSOCIATED WITH MATERNAL DEATHS BY ZONE, CONT'D

Table 22. Factors associated with maternal deaths by zone, cont'd

Associated Factor	Total (n=809) n (%)	North (n=47) n (%)	Central East (n=162) n (%)	Central West (n=175) n (%)	South East (n=212) n (%)	South West (n=213) n (%)
Administrative Factors						
Any administrative factor	384 (47.5%)	22 (46.8%)	86 (53.1%)	86 (49.1%)	101 (47.6%)	89 (41.8%)
Communication problems between facilities	59 (7.3%)	5 (10.6%)	10 (6.2%)	9 (5.1%)	22 (10.4%)	13 (6.1%)
Transport problems between facilities	51 (6.3%)	7 (14.9%)	10 (6.2%)	4 (2.3%)	16 (7.5%)	14 (6.6%)
Lack of qualified staff	21 (2.6%)	3 (6.4%)	3 (1.9%)	6 (3.4%)	2 (0.9%)	7 (3.3%)
Lack of antibiotics	15 (1.9%)	1 (2.1%)	2 (1.2%)	6 (3.4%)	5 (2.4%)	1 (0.5%)
Lack of essential obstetric drugs	44 (5.4%)	3 (6.4%)	11 (6.8%)	4 (2.3%)	17 (8.0%)	9 (4.2%)
Lack of essential equipment	182 (22.5%)	11 (23.4%)	38 (23.5%)	48 (27.4%)	47 (22.2%)	38 (17.8%)
Lack of laboratory facilities	66 (8.2%)	3 (6.4%)	19 (11.7%)	21 (12.0%)	12 (5.7%)	11 (5.2%)
Lack of blood transfusion	86 (10.6%)	5 (10.6%)	31 (19.1%)	17 (9.7%)	13 (6.1%)	20 (9.4%)
Absence of trained staff on duty	18 (2.2%)	2 (4.3%)	4 (2.5%)	7 (4.0%)	3 (1.4%)	2 (0.9%)
Patient or Family factors						
Any patient or family associated factors	390 (48.2%)	22 (46.8%)	94 (58.0%)	77 (44.0%)	108 (50.9%)	89 (41.8%)
Delay in reporting to the health facility	306 (37.8%)	15 (31.9%)	83 (51.2%)	51 (29.1%)	86 (40.6%)	71 (33.3%)
Lack of transport from home to facility	18 (2.2%)	1 (2.1%)	6 (3.7%)	1 (0.6%)	7 (3.3%)	3 (1.4%)
Unsafe traditional/cultural practices	28 (3.5%)	0 (0.0%)	9 (5.6%)	4 (2.3%)	11 (5.2%)	4 (1.9%)
Unsafe self-medication	25 (3.1%)	0 (0.0%)	7 (4.3%)	5 (2.9%)	7 (3.3%)	6 (2.8%)
Refusal of treatment	36 (4.4%)	3 (6.4%)	7 (4.3%)	9 (5.1%)	10 (4.7%)	7 (3.3%)
Delay in decision-making	230 (28.4%)	12 (25.5%)	65 (40.1%)	38 (21.7%)	60 (28.3%)	55 (25.8%)
Use of traditional medicine/practices	23 (2.8%)	0 (0.0%)	3 (1.9%)	6 (3.4%)	8 (3.8%)	6 (2.8%)

FACTORS ASSOCIATED WITH MATERNAL DEATHS BY ZONE, CONT'D

Table 22. Factors associated with maternal deaths by zone, cont'd

Associated Factor	Total (n=809) n (%)	North (n=47) n (%)	Central East (n=162) n (%)	Central West (n=175) n (%)	South East (n=212) n (%)	South West (n=213) n (%)
Traditional birth attendant or Community factors						
Any traditional birth attendant or Community	72 (8.9%)	1 (2.1%)	22 (13.6%)	7 (4.0%)	28 (13.2%)	14 (6.6%)
Failure to recognise danger signs	51 (6.3%)	0 (0.0%)	12 (7.4%)	5 (2.9%)	23 (10.8%)	11 (5.2%)
Failure to accept limitations	23 (2.8%)	1 (2.1%)	7 (4.3%)	2 (1.1%)	9 (4.2%)	4 (1.9%)
Use of traditional medicine	7 (0.9%)	1 (2.1%)	4 (2.5%)	0 (0.0%)	2 (0.9%)	0 (0.0%)
Lack of transport	3 (0.4%)	0 (0.0%)	2 (1.2%)	0 (0.0%)	1 (0.5%)	0 (0.0%)
Delay in deciding to refer	29 (3.6%)	0 (0.0%)	12 (7.4%)	4 (2.3%)	10 (4.7%)	3 (1.4%)

APPENDIX 10.
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APPENDIX 11.
FULL RECOMMENDATIONS

To formulate recommendations from the findings of this report, we convened a workshop of representatives from all levels of the health system, Ministry of Health and donor/partner organisations (see Appendix 10). Findings of the report were presented, organised into the following categories:

1. WHO died – demographic details, mode of delivery, location admitted from, condition received in.
2. WHY women died – leading medical causes of death, avoidable factors in maternal deaths
3. WHERE women died – geographical variations in maternal death across Malawi, focus on specific zones and facilities
4. WHEN women died – timing of maternal deaths

Following the presentation of each category of findings, attendees broke into small groups to make recommendations aimed at each level of the health system and community. Every group made recommendations on every category and these were compiled into a long list of recommendations made by the workshop. Following generation of the long list of recommendations, attendees were split into groups and asked to prioritise recommendations made within each category. Attendees were asked to perform this task out on the basis of the frequency with which the recommendation was made in the long list, the perceived impact and achievability of the recommendation. This list is included in full below. The prioritised list of recommendations was taken forward and presented to the NCCEMD.

The NCCEMD identified key themes into which the recommendations fell:

- Improving the referral and admission process
- Reducing deaths following Caesarean sectionTackling the leading causes of maternal death
- Addressing healthcare worker factors involved in maternal deaths
- Improving health-seeking behaviour at a community level

The NCCEMD then nominated three small working groups to take forward the consolidation of recommendations from the list generated by the recommendations workshop under these themes to produce the final recommendations outlined in section 6 of this report.

LIST OF RECOMMENDATIONS TO PREVENT MATERNAL DEATHS GENERATED BY WORKSHOP ATTENDEES

WHO died

Recommendations for Zonal/national level:

- Ensure those conducting supervision of lower levels of staff have technical expertise
- Sensitisation of HCWs to patients' rights and respectful maternity care
- Create policies on equitable distribution of resources according to need – human vehicles, ORT
- Increased decentralisation of decision-making about distribution of HCWs, employment, discipline
- Improve competencies of clinical officers conducting Caesarean sections by improving training structure – certify only certain facilities to train them
- Ensure periodic reviews for all training institutions to keep up to date with modern evidence-based medicine
- Strengthen work ethic amongst HCWs.

Recommendations for Central Hospitals:

- All referrals should be attended to in a timely way by a qualified HCW
- Improve infection prevention at Caesarean section at all facilities carrying out the procedure
- Improve mentorship, supervision, CPD and feedback from central hospitals for those at district and primary level
- Sensitise HCWs on patients' rights and respectful maternity care
- Improve availability of drugs, specifically MgSO4, TXA, misoprostol
- Increase numbers of qualified personnel
- Increase capability of CCSD and increase availability of equipment
- Strengthen work ethic

Recommendations for District Hospitals:

- All patients referred from health centres to be seen on arrival by an appropriately qualified member of staff
- Adherence to protocols and guidelines to improve care, tracked through supportive supervision, mentoring, CPD
- Pre-referral checklist to accompany patient on transfer with specific checklist for each obstetric emergency (e.g. eclampsia – did you give MgSO4?)
- Sensitise HCWs on patients' rights to respectful and quality maternity care
- Improve availability and use of drugs for PPH management: TXA, Misoprostol
- Clinical CPD linked to a person's job role in order to re-register every year – not random courses to meet number of credits
- Improve transport by making community hospitals the host for fuel and other resources so that they can obtain fuel without going to the DHO
- Strengthen work ethic
- Increase number of facilities that can perform Caesarean section per health area

Recommendations for Primary healthcare:

- Improve early identification of high-risk women through use of maternity EWS chart
- Improve safety of referrals through pre-referral checklist and equitable distribution of vehicles
- Meet with traditional healers to discourage the use of local pitocin
- Improve availability of medical supplies for aseptic vaginal examinations – antiseptic/gloves/sterilising facilities
- Increased availability of batteries or switch to rechargeable equipment for monitoring vital signs
- Strengthen work ethic

Recommendations for Community level action:

- Strengthen community awareness of the need for early health-seeking behaviour by sharing data to empower women and their communities
- Incentivise male involvement in Antenatal care
- Work across sectors to improve education of girls
- Increase numbers of midwifery community workers

WHY women died

Recommendations for Zonal/national level:

- Improve availability of tranexamic acid by adding to essential drug list and make it available at CMST and ensure education and training in its use
- Ensure availability of magnesium sulphate and oxytocin at all levels
- Regular updates to national guidelines based on current evidence including management protocols for emergencies – eclampsia/sepsis/PPH
- Adopt national protocol for vaginal cleansing immediately before incision at Caesarean section and use of a Safe Caesarean surgical checklist (adapted from WHO Surgical Checklist) and pro forma for operation note documentation
- Nationally standardised admission assessment forms
- Improve road network
- Improve working conditions for HCWs – working environment and renumeration
- Reduce off-site training for management level staff at facilities to increase their time available for on-site supervision/mentoring of junior staff

Recommendations for Central Hospitals:

- Improve postnatal care with regular monitoring of vital signs, and discharge information clearly communicated to women
- Increase ICU capacity
- Improve availability of supplies for aseptic techniques
- Improve targeted antibiotic therapy through improved laboratory capacity to culture organisms/detect resistance
- Improve availability of stationary
- Triage those arriving using EWS to ensure women critically ill receive timely care

Recommendations for District Hospitals:

- Improve postnatal monitoring by introducing a post-natal booklet with prompts and areas for documentation – frequency of observations, 3rd stage checks/4th stage checks
- Improve supply and use of tranexamic acid
- Improve availability of supplies for infection prevention – antiseptics, sterile equipment
- Improved referral structure – enable HCWs to accompany and return to improve monitoring en route, ensure referral called in to receiving facility ahead of time
- Audit use of partograph (this would help reduce PPH deaths)
- Strengthen leadership at facility level – training courses, strengthen accountability, ask managers to spot-check on staff presence/absence

Recommendations at Primary healthcare level:

- Strengthen skills in managing obstetric emergencies through – mentorship, skills drills training in every facility every quarter (non-pneumatic antishock garment, partograph, manual vacuum aspiration), regular/planned CPDs, audit and QI projects
- Improve availability of resources – specifically blood pressure machines and batteries, stationary, essential drugs and antiseptic (tranexamic acid, magnesium sulphate, ferrous sulphate)
- Ensure good pre-referral management – keep monitoring until patient leaves!
- Improve accountability at management level

Recommendations at Community level:

- Improve antenatal education about risks of infection and how to prevent it in pregnancy and childbirth (delivered through health system assistants, community midwifery assistants, community leaders and antenatal midwives)
- Recommend bathing to patients in early labour and those having a planned Caesarean section
- Empower women to seek emergency care and have a birth preparedness plan to include emergencies developed in partnership with men
- Strengthen uptake of family planning (reduce unwanted/unplanned grand multiparity)

WHERE women died

Recommendations for Zonal/National level:

- Have clear referral guidelines at each level of health system – referral criteria, policy on referral process.
- Ensure that recommendations made from MD report are implemented and followed up
- Ensure that those that make laws/rules are aware of the contextual matters (what is going on on the ground)

Recommendations for Central Hospitals:

- Triaging of referred patients using maternal early warning scores
- Reinforce pre-referral consultation and management

- Strengthen HCW skills
- Timely feedback to referring facilities
- Behaviour change – especially on attitudes towards patients and fellow staff
- Improve monitoring of patient care

Recommendations for District Hospitals:
- Strengthen HCW skills and competencies (EMONC signal functions, early referral and pre-referral care)
- Timely feedback – share results from audits with healthcare workers
- Implement/reinforce pre-referral consultations and management
- Increase HDU spaces and trained personnel at district facilities

Recommendations for Primary healthcare:
- Strengthen HCW skills and competencies
- Timely feedback and sharing of audit outcomes at the facilities for action
- MD review audits to focus on action to be taken for quality promotion
- Make sure all community clinics and hospitals are able to do signal functions and make them cost centres to make sure they have enough resources

Recommendations at Community level
- Promote early health-seeking behaviour
- Share the data on MDs with community for them to act on

WHEN women died
Recommendations at Zonal/national level:
- Increase availability of blood products including whole blood, fresh frozen plasma and platelets
- Adopt a national protocol for vaginal cleansing prior to Caesarean section
- Develop and adopt a postnatal discharge document/checklist standardised for use across facilities

Recommendations for Central Hospitals:
- Capacity building to provide skills and competencies to improve care

Recommendations for District Hospitals:
- Improve referral system through improved communication, timely referral, quick transportation and pre-referral checklist form
- Increase capacity to perform baseline full blood count/haematinics in pregnancy
- Improved capacity for investigations at district-level, e.g. cultures and sensitivity

Recommendations for Primary healthcare:
- Improved monitoring in first 24 hrs after delivery (e.g. adopt a postnatal monitoring booklet)
- Improve availability of post-abortal care through use of misoprostol
- Capacity-building at health centres on recognising and managing danger signs
- Improve feedback to HCs from higher levels

Recommendations at Community level:

- Improve pre-conception care to increase use of early antenatal care, folic acid and educate about danger signs in early pregnancy and the postnatal period
- Community mobilisation for the removal of legal barriers to safe abortion

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