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ASSESSING THE HEALTH SYSTEM FACTORS AFFECTING MATERNAL MORTALITY IN THE CENTRAL REGION

BY

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DECLARATION

Candidate's Declaration

I David Theophilus Walawah hereby declare that this work is the result of my own research and has not been presented by anyone for any academic award in this or any other university. All references used in the work have been fully acknowledged.

Any shortfalls therein are my sole responsibility.

Candidate's Signature:  Date 10/02/2023

Name: David Theophilus Walawah (10937570)

Supervisor's Declaration

I thus certify that the submission of this thesis was duly overseen by me in accordance with the University of Ghana's School of Public health's (SPH) criteria for writing a dissertation.

Supervisor's Signature:  Date: 10/02/2023

Name: Dr Leonard Baatiema

DEDICATION

This work is dedicated to the Almighty God for making it possible for me to successfully complete this study, and then to my family and friends for their selfless devotion, motivation, and support throughout this period.

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God richly bless you.

ABSTRACT

Background: In spite of various interventions, Ghana still struggles to reduce the maternal mortality ratio at a faster pace. Several studies have been conducted to identify the direct and indirect causes of maternal mortality. However, fewer studies have addressed the health system-related factors or challenges that contribute significantly to maternal mortality.

The aim of this study was to analyze the health system challenges that contribute to maternal mortality in the central region of Ghana and identify ways to help reduce them. Based on the findings, make recommendations to improve maternal health.

Methods: The study was conducted by reviewing maternal mortality audit reports of maternal deaths that occurred between 1st January 2019 to 31st December 2021. A total of 98 reports were reviewed, after which 14 stakeholders were interviewed using a semi structured questionnaire. Descriptive statistics and inferential statistics using a multinomial regression analysis were generated using STATA 16. Statistical significance was assumed at $p<0.05$.

Results: Health system challenges contributed to as high as 87.25% of maternal mortalities over the period of study. The challenges were mainly delayed in the intervention (59.18%), lack of equipment and consumables (41.84%), lack of expertise inadequate knowledge and skills (37.76%), inadequate human resources (24.49%), Communication breakdown (22.45%) and transportation challenges (13.27%). None of the deaths were attributable to all the factors, however, 10 mortalities had more than 3 factors contributing with 23 deaths having 3 factors contributing.

After a multinomial regression analysis, it was established that lack of expertise, inadequate knowledge and skills ($p< 0.04$), and inadequate human resources ($p< 0.031$) contributed significantly to mortalities in women who had cesarean sections. It was again established that a higher percentage of the mortalities in the lower levels of care were due to a lack of expertise.

Conclusion: Health system challenges contributed significantly to maternal deaths in the Central Region. Strengthening the health system by improving the knowledge and skill of health workers, increasing the number of health workers especially experts in the field of maternal care will help to eliminate some of the identified challenges and improve the reduction rate of maternal mortality ratio in the Central Region of Ghana.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

CCTH	Cape Coast Teaching Hospital
CHPS	Community Health Planning and Services.
GDHS	Ghana Demographic and Health Survey
GMHS	Ghana Maternal Health Survey
GSS	Ghana Statistical Service
MDG	Millennium Development Goals
MM	Maternal Mortality Ratio
SDG	Sustainable Development Goals
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

At the end of the Millennium Development Goals (MDGs) in September 2015, the Maternal Mortality Ratio (MMR) had declined by 43.9 % between 1990 to 2015 (Alkema et al., 2016). Despite this significant drop, the global target of a 75 % reduction as stated during the United Nations millennium declaration 2000, was not achieved (Alkema et al., 2016).

The International Classification of Diseases (ICD-10) defines maternal death as "The death of a woman while pregnant or within 42 days of the end of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes" (World Health Organization,2010).

Most maternal deaths cluster around labor, delivery and the first 24 hours after delivery, and are as a result of obstetric emergencies. Obstetric emergencies are life-threatening medical complications that occur during pregnancy, labor or birth. (Knight et al., 2013) Obstetric emergencies contribute to 15 percent of maternal deaths globally. (Knight et al., 2013) Maternal deaths can be prevented with proper antenatal care and support during labor (e.g., assisted delivery, cesarean section, or blood transfusions) (United Nations Fund for Population Activities (UNFPA, 2012). However, in sub-Saharan Africa (SSA), many maternal deaths are due to obstetric complications (Kyei-Nimakoh et al., 2016). About 75% of maternal deaths are linked to direct obstetric factors such as postpartum hemorrhage, sepsis, pre-eclampsia and eclampsia, birth complications, and unsafe abortions (Ghana Statistical Service (GSS), 2018). Even though many of these direct causes of maternal deaths are preventable, poor access to

skilled care in Ghana and other countries in SSA leads to an increased risk of extreme obstetric complications and death. It is against this background that the Sustainable Development Goals (SDGs) renewed the commitment to achieving a global maternal mortality ratio of less than 70 per 100 000 live births by 2030 (United Nations General Assembly (UNGA) ,2015,SDG indicator 3.1).

Studies conducted previously highlighted non-availability of care, poor quality of care and ignorance of the need for obstetric care for the disparity in maternal mortality rates between SSA and other parts of the world (Kyei-Nimakoh et al., 2016).

The Central Region of Ghana had a maternal mortality ratio of 104/100000 live births in 2021, which was slightly lower than the national figure (Central Regional Health Directorate, unpublished data, 2022). A lot of interventions have been instituted at the regional level to reduce maternal mortality. Notable amongst them is dividing the region into zones and assigning obstetrician gynecologists to each zone to help in training doctors and midwives and nurses in each zone, and also help with management of cases on phone and referrals. Another important intervention is the annual lifesaving skills (LSS) training workshops to train health care workers in the management of obstetric emergencies.

Despite all these interventions, preventable maternal deaths are still high in the region. There are identified health system gaps or challenges that contribute to some of these mortalities (Geleto et al., 2018).

There is therefore the need to identify these health system related factors and recommend ways to curb them to reduce maternal mortalities in the region. These system challenges are likely to be found in other regions since the systems are run in a similar faction.

1.2 Problem Statement

Socio-economic underdevelopment is closely linked with numerous challenges in the health system, and these contribute to the differences observed in maternal mortality ratios between countries. To prevent maternal deaths, there should be no barrier to accessing quality health care. The socio-economic status or place of residence should not impede access to quality obstetric care. There should be access to emergency obstetric care at various localities especially in rural areas. Women in rural areas should receive optimum care at each level from the level of CHIPS compound to the Teaching Hospital level. The referral system should be effective with adequate experienced health personnel at all levels of care to prevent maternal deaths. (Singh et al., 2015).

Despite the success of the Free Maternal Health Care Policy (FMHCP) under the NHIS, data from Ghana's 2017 maternal health survey indicates that more than three-quarters (79%) of live births or stillbirths were delivered in a health facility, primarily in public sector facilities, while 1 in 5 births or stillbirths were home deliveries (Ghana Statistical Service (GSS) 2018). These pregnant women who deliver at home are at increased risk of developing post-delivery complications or dying due to lack of skilled health personnel to attend to such complications in time (Browne et al., 2016). It is known that some women prefer home delivery because of previous poor treatment received at health facilities and a perceived maltreatment and substandard care they are likely to receive if they intend to deliver at health facilities (Austin *et al*, 2015).

From the GMHS 2017, the central region has one of the lowest health insurance coverages for women in their fertility age (WIFA). The Percentage of WIFA with health insurance coverage in the central region is 40%, only better than greater Accra with 39%. The national average insurance coverage is 46%. Inability pay for medical

services is one of the major hindrances to quality health care delivery. Some women prefer to deliver at home simply because they cannot afford the charges at the hospitals, or they don't receive quality services at the hospital or both.

From the same document, central region had the 3rd lowest percentage of women who took iron tablets or syrup during pregnancy 93.3%, only above the Volta and Western regions. This reflects poor ANC attendance and or care which contribute significantly in maternal deaths.

Only 70% of women had ANC, assistance at delivery and postnatal care in the central region. ((Ghana Stastistical Service (GSS),Ghana Health Service (GHS), and ICF. 2018) Ghana Maternal Health Survey 2017. Accra, Ghana.

According to the GMHS 2017, More than half (53.6%) of women in the central region at least had one problem accessing healthcare. This was mainly due to poor road networks and long distances between health facilities (Ghana maternal health survey 2017 pp. 72).

Several health system related challenges could be identified from most of the indicators for the Central Region in the GMHS 2017 discussed above. It is important to know how these factors contribute to maternal mortality in the region and the views of the health care workers and managers in the region on how these challenges can be eliminated. The central region had 204 maternal deaths between January, 2019 and December, 2021. (Central Regional Health Directorate unpublished data, 2022). The Central Regional maternal mortality audit reports need to be analyzed to identify the various health system-related factors contributing to maternal deaths.

1.3 Study Rational

This study seeks to identify the various bottlenecks in the management of critically ill obstetric patients in the Central Region. Gaps in management of patients at all levels, defects in the referral and transportation systems contributing to mortalities. Lack or inadequate logistics and equipment in the management of patients etc. The study will help identify human resource related challenges, service delivery issues, financial constraints contributing to maternal deaths, poor information management systems, and the overall governance issues affecting the care of pregnant women in the region. It also seeks to find solutions from the health workers and managers as to how these challenges can be minimized.

1.4 General Objective

To examine the health system factors contributing to maternal deaths in the maternal mortality audit reports of the central region.

1.4.1. Specific Objectives

1. To identify the contributory factors to maternal mortality in the Central Region.
2. To estimate the proportion of maternal deaths that are attributable to health system-related factors in the Central Region.
3. To identify the ways in which the health system-related factors contributed to maternal deaths in the Central Region.
4. To explore the views of health workers and managers on strategies and measures that can address the health system-related factors which contribute to maternal mortality in the Central Region.

1.5 Research Questions

1. What are the contributory factors to maternal mortality in the Central Region?
2. What proportion of maternal deaths are attributable to health system related factors?
3. In what ways did the health system factors contribute to maternal mortality in the Central Region?
4. What are the views of health workers and managers on strategies and measures to address the health systems factors which contribute to maternal mortality in the Central Region?

1.6 Conceptual Framework

A conceptual framework was designed for the purpose of this research to establish the linkages between the various personal, family and health system factors that contribute to maternal deaths.

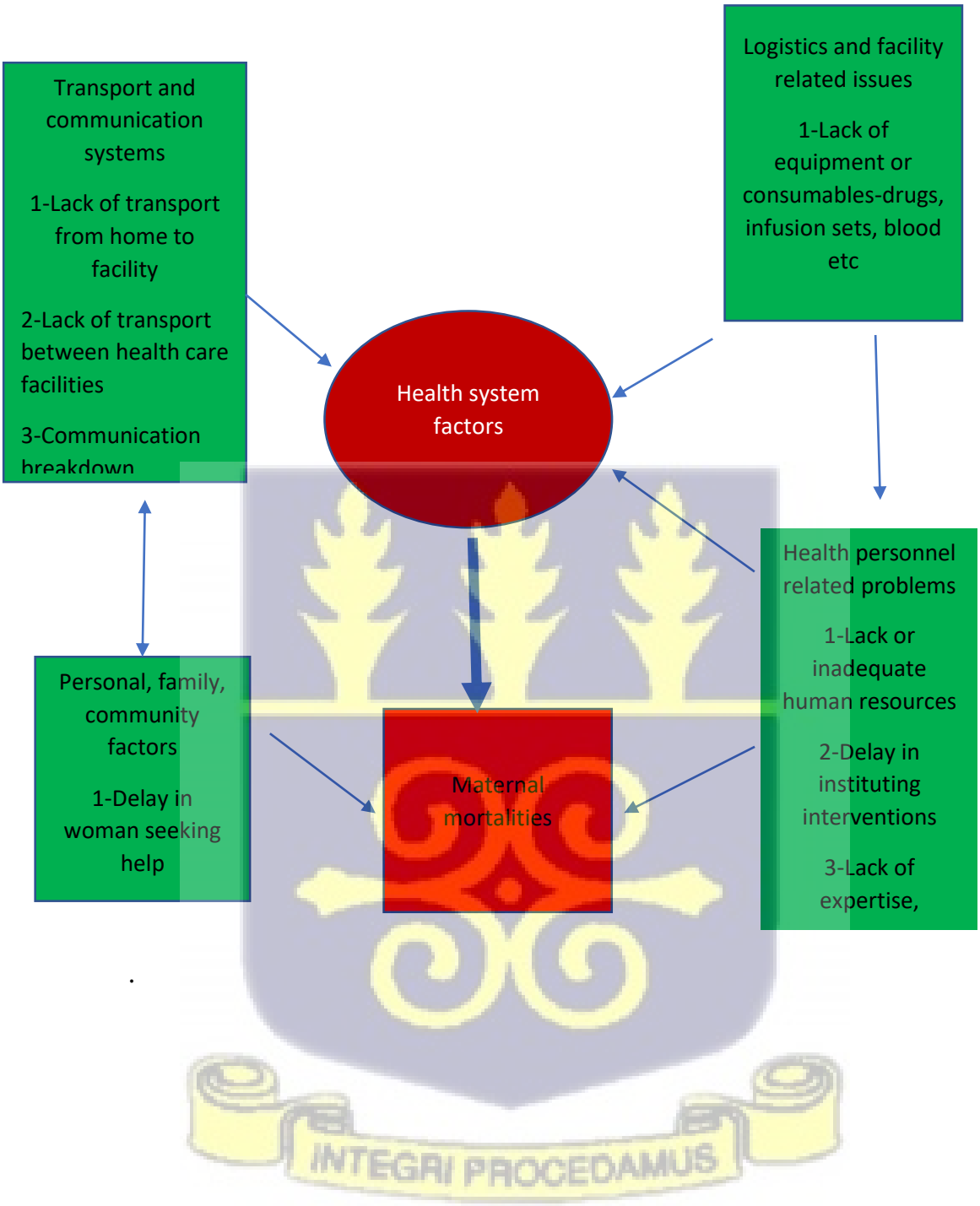
Transport and communication challenges contribute to delay in patients reaching health facilities and receiving appropriate and timely care which in the end can contribute to maternal death. Families with means of transportation can transport the sick woman between health facilities in the absence of ambulance which could prevent unnecessary delay in receiving care.

Lack of logistics at the health facilities leads to delay in instituting appropriate interventions or not intervening at all. This also contributes to maternal deaths.

Health personnel factors such as lack of expertise contribute directly to maternal deaths. Lack of personnel also leads to unnecessary referrals which contribute to the delay in instituting interventions and hence maternal deaths.

Personal, family and community level factors such as ignorance and poverty will make it difficult for women to decide to go to the hospital when there is a problem or to afford transportation to the health facilities respectively, contributing to the delay in receiving care. Communities without well-equipped health facilities will have to rely on facilities in nearby towns. Those with poor road network have challenges in reaching these health facilities for treatment. All these contribute to maternal morbidity and mortality. However, this is not a direct health system challenge but it contributes to the transportation challenge. These four major factors are linked such that all of them either directly or indirectly lead to delay in treating women with pregnancy and delivery complications appropriately and thereby causing preventable maternal deaths.

Figure 1: Conceptual framework on the relation between health system factors, personal and community factors and maternal mortalities.



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CHAPTER TWO

LITERATURE REVIEW

2.0. Search Strategy

PubMed, Google scholar and Science direct were the search engines used to assemble articles and for the literature review. In PubMed, 'Maternal mortality' 'Ghana' were the search terms, and 1,768 results were generated from which five journal articles were selected. In science direct, the same search terms were used which generated 3970 results. Preliminary screening of abstracts based on their relevance to the research topic led to the selection of four peer-reviewed articles. The relevant articles were those that had information on factors leading to maternal deaths, health system related factors causing maternal deaths. In Google Scholar, maternal mortality, Ghana was used as the search terms and the results obtained were filtered using "since 2012" which yielded 61400 articles. Three peer-reviewed articles which were suitable were incorporated into the literature review. Another search using Health system-related factors causing maternal deaths in Ghana was conducted. It yielded 20,200 results out of which four suitable peer-reviewed journals were chosen. Several other articles reviewed were drawn from journals whiles others were hand searched reports from peer review articles and dissertations by students.

2.1. Definition of Terms

Maternal mortality ratio is the number of deaths per 100,000 live births in a period (year). Maternal mortality rate is the number of maternal deaths within a period over the number of Women In their Reproductive Age (WIFA) during the same period expressed per 100,000 women.

Mathematically, the two are expressed as;

$$maternal\ mortality\ ratio = \frac{total\ number\ of\ maternal\ deaths\ per\ year}{total\ number\ of\ live\ births\ per\ year} \times 100000$$

$$maternal\ mortality\ rate = \frac{total\ number\ of\ maternal\ deaths\ per\ year}{total\ number\ of\ WIFA\ per\ year} \times 100000$$

2.2. Maternal Mortality at Global and National Levels

The majority of countries fell short of attaining MDG 5 targets for Maternal Mortality reduction. Approximately 303,000 maternal deaths occur each year which is unacceptably high, with the largest burden in Sub-Saharan Africa and Asia (Lewis, 2014). Maternal Mortality Ratio reduced consistently in south, east, and southeastern Asia between 1990 and 2013, but increased in much of Sub-Saharan Africa during the 1990s (Manuscript, 2017).

The Ending Preventable Maternal Mortality (EPMM) Working Group led by the World Health Organization (WHO) came out with targets for maternal mortality reduction at the global and country levels. These targets were to reduce the global average maternal mortality ratio (MMR) to less than 70 maternal deaths per 100,000 live births by 2030. Each country is expected to reduce its maternal mortality ratio by at least two thirds from 2010 baseline, and no country should have a ratio higher than 140 deaths per 100,000 live births. In addition, all countries were tasked to achieve equity in MMR among sub-populations. A comprehensive paper outlining the

Strategies toward Ending Preventable Maternal Mortality (EPMM) was released by WHO in February 2015.

A pregnant woman in Sub-Saharan Africa has the highest risk of dying during childbirth than in any other region of the world (World Health Organization, 2014) A 15-year-old female living in Sub-Sahara Africa has a one in 36 risk of dying during pregnancy and childbirth over the course of her lifetime, compared to a female the same age residing in Europe whose risk is one in 3300 (WHO maternal mortality report 2017 pp. 39). Similarly, the 2014 WHO maternal mortality fact sheet reported that an estimated 800 women die every day from pregnancy related complications (WHO maternal mortality fact sheet, 2014). Almost all of these maternal deaths (99% of Global Maternal deaths) happened in developing countries, and 66% of these deaths were recorded in Sub-Saharan Africa countries (Jolivet et al., 2018). The probability of a woman dying during pregnancy, child birth in Africa is 1 in 40 (Muchemi et al., 2016).

Similar to many countries in SSA, Ghana's maternal mortality ratio remains high at 310 per 100 000 live births (Ghana Stastistical Service (GSS),Ghana Health Service (GHS), and ICF. 2018) Ghana Maternal Health Survey 2017. Accra, Ghana. Ghana continues to have persistently high levels of preventable maternal deaths. Autopsy studies indicate that about 81% of deaths recorded occurred in the community or within 24 hours of admission to a health facility (Moyer et al., 2013).

Causes of maternal deaths are either direct or indirect with a few being unclassified. Direct maternal deaths result from obstetric complications of the pregnant state, from interventions, omissions, inappropriate treatment, or from a combination of any of the above. Indirect maternal deaths are deaths from diseases that predated the pregnancy or from conditions that developed during the pregnancy which were not due

to obstetric causes but were however made worse by the physiologic changes caused by the pregnancy (Lee et al., 2012).

In developing countries, many women prefer to deliver at home because of the poor quality of care they receive at health facilities. This phenomenon is common in the rural areas of developing countries (Austin et al., 2015). This posts a great risk to these mothers because it leads to delay in instituting interventions when complications arise during and after delivery.

2.3. Ghana's Maternal Mortality Situation

According to the 2014 Ghana Demographic Health Survey (GDHS) report (GSS, 2015), Ghana is unlikely to meet this target considering the fact the current maternal mortality ratio is 310 with a gradual decrease of less than 3 per year since 1990. Although there are significant improvements on Ghana's maternal mortality figures, Ghana still needs to focus on increasing its rates of live births and universal access to maternal healthcare. According to the 2017 Ghana Maternal Health Survey (GMHS), (GSS, 2018), maternal mortality in Ghana accounted for 14% of all deaths, 10% from direct maternal causes and 4% from indirect maternal causes. This implies that two-thirds of deaths (67%) were direct maternal deaths. In addition, more than one quarter (27%) were indirect maternal deaths, and another 6% were due to unspecified maternal causes. The common causes of direct maternal deaths are obstetric hemorrhage (30%), followed by hypertensive disorders (14%), and sepsis (10%) which results from complications due to non-medical abortions.

2.4 Drivers of Maternal Mortality (Global, National and Local Levels)

Several factors affect maternal mortality, demographic features such as educational level have been known to influence maternal deaths with women who had no education having a higher risk of dying (Yego et al., 2014). Socio-economic status has been found to be strongly linked with maternal deaths. With women of poor socio-economic status having increased risk of maternal deaths (Id et al., 2018). In Northern Ghana, travel time or distance, inadequate transports, bad roads, and poor distribution of health facilities were the major cause of the second delay (Thaddeus & Maine, 1994) (Edward, 2015). Factors such as inadequate competent staff, poor staff attitude and challenges with logistic were the main cause of the third delay in Northern Ghana (Thaddeus & Maine, 1994) (Edward, 2015).

Other factors such as underlying medical conditions and patients obstetric condition such as eclampsia, antenatal attendance and presence of a doctor at delivery all influence maternal deaths (Yego et al., 2014). Factors situated in the health system such as human resource challenges, transportation and communication problems and equipment and logistics challenges contributes significantly to maternal deaths. These factors vary based on the certain which leads to the observed discrepancies in maternal mortality rates across the globe (Arulmohi et al., 2017).

2.5. Health System Challenges and Maternal Mortality

Health system factors contribute significantly to avoidable maternal deaths. With the three 'delay' model in maternal mortality, the first delay is usually due to patient factors which might be influenced by poor care received previously or high cost of health care (Kruk et al., 2017). The second delay is due to transportation challenges

from the various homes to health facilities or between health facilities. Part of this problem lies within the health system where ambulances are not available or accessible to transport critically ill patients from the peripheral hospitals to the referral centers (Owusu-sarpong et al., 2017). The third delay is purely a health system problem. The timeliness of receiving care in the hospital is dependent on among other things functioning emergency systems, availability of skilled staff, blood transfusion services, and theater services, availability of drugs, consumables and equipment; and adherence to treatment protocols and guidelines (Issah et al., 2011). Factors such as delays in referrals, lack of transportation, lack or inadequate supervision of inexperienced staff, inadequate numbers of experienced doctors and midwives, lack of space at the intensive care unit as well as lack of blood and blood products are some of the main challenges in managing obstetric emergencies and critically ill mothers. These factors contribute to preventable maternal and fetal deaths. Most Teaching Hospitals are not well equipped, staffed and funded to address some of these indirect causes of maternal deaths (Owusu-sarpong et al., 2017). To end preventable maternal deaths, it is crucial that countries develop systems and processes to ensure the ability to count every maternal death and identify the cause of death and contributing conditions. In Ghana maternal mortality audits are mandatory for all maternal death, with the auditing done at the facility, District and regional levels. This is to help identify where and how the availability or coverage as well as quality of care need to be improved. Most of the times these audit reports are not analyzed to tease out the various factors leading to maternal deaths. In the instances when the reports are analyzed it is mainly the factors pertaining to service delivery that are taken up and addressed. A thorough breakdown of the various health system related factors such as the WHO's six building blocks for health systems strengthening is rarely done. To drastically reduce maternal deaths, the

various health system gaps in the particular facility, zone, region or country needs to be identified and resolved.

Access to quality healthcare has a strong impact on the maternal mortality situation of a country. In the context of Ghana, a number of interventions are in place to reduce barriers to access and increase the use of skilled maternal healthcare. These interventions include a user-fee exemption policy for expectant mothers under the National Health Insurance Scheme (NHIS), a Maternal and Child Health Integrated Program (MCHIP), the Community-Based Health Planning and Services (CHPS) initiative and the skills upgrading of community health nurses into Community Health Officers (CHOs) to improve management of complications during pregnancy and delivery (Ganle et al., 2014).

While these interventions have generally contributed to improvement in access to skilled maternal healthcare in Ghana, far less progress has been achieved in terms of reduction of maternal deaths (Sumankuuro et al., 2020).

2.6. Maternal Mortality Audits

Maternal mortality audits are conducted to investigate maternal deaths and identify the various factors contributing to the individual deaths. Data are aggregated from facility and community level to higher levels to gain deeper insight into quality of care gaps and address wider systemic barriers (Lewis, 2014). This information is subsequently made available to those in a position to act on the evidence. It often comes out from the audit reports that local and less resource-intensive solutions can save lives (Bandali et al., 2016). It is therefore important to continue auditing maternal deaths to help identify the various missed opportunities and gaps contributing to maternal deaths.

Systems should be set up in a way that ensures all maternal deaths are reviewed, or at the very least, analyze a sufficient number of cases to avoid biases and promote system-wide learning (Bandali et al., 2016).

A paucity of published data on the outcomes, particularly at local level, has led some to question the utility of such reviews. However, for many their benefits are well proven, particularly for the well-established population-based audits such as the 60-year-old UK Confidential Enquiries into Maternal Deaths. (Kerber et al., 2015) A large randomized control trial in West Africa has shown a significant reduction in the maternal mortality ratio in participating hospitals in Mali and Senegal. (De Brouwere & Van Lerberghe, 2001)

It is important that due recognition be given to smaller, often qualitative, studies because it is from these audits that often nuggets for local improvement lie (Ivers et al., 2012).

The role of the 'maternity conscience' is clear, as is the vision to improve quality of care through the development of a positive institutional learning environment within health facilities and communities. This can be achieved by reviewing the audit report of the facility or the region. Beneficial changes which ultimately improves the quality of healthcare are seen as a result. The benefit of audit and feedback has been acknowledged by development partners and governments to prevent further deaths of mothers (Kerber et al.,2015). There should be a renewed focus on quality improvement of health-system delivery by policy-makers, managers and health-care providers, working at all levels of health-care systems in resource poor settings (Nambiar et al., 2017).

CHAPTER THREE

RESEARCH METHODS

3.0. Introduction

This chapter describes the approach adopted for the examination of the maternal mortality audit reports and the interview conducted. It includes the study design, data collection techniques and the statistical methods used for the data analysis.

3.1. Study Design

Mixed method design was used due to the nature of the study. A retrospective analysis or review of maternal mortality records. Aggregate data on maternal deaths that occurred in the Central Region during the study period (1st January 2019 to 31st December 2021) was collected from the completed maternal mortality audit reports from the Central Regional Health Directorate. Patient-level data were extracted and coded. The reports were thoroughly reviewed to identify the factors contributing to maternal deaths and the magnitude of the contributions to maternal deaths. In-depth interviews were conducted among health workers and managers involved in maternal mortality auditing in the region to obtain recommendations from stakeholders on how to reduce these deaths. A semi structured questionnaire was used to gather the information.

3.2. Study Area

Figure 2: Study Region: Central Region Of Ghana

The Central Region is one of the sixteen administrative regions of Ghana (The Local Government System in Ghana, 2020). The Central Region has Cape Coast as its capital. Cape Coast was the capital of the Gold Coast until the capital was moved to Accra in 1877. (Ghana Statistical Service [GSS], 2013). It occupies an area of 9,826 square kilometers or 4.1 percent of Ghana's total land area of 238,533 square kilometers, making it the third smallest in area after Greater Accra and Upper East (GSS). It is bordered by Ashanti and Eastern regions to the North, Western region to the West, Greater Accra region to the East, and to the South by the Gulf of Guinea [168-kilometre length Atlantic Ocean] (the Local Government system in Ghana, 2015). The Central region is the center of education with some of the best schools in Ghana, and well-known for its many elite higher educational institutions. The region has 3 public

universities, namely; University of Cape Coast, University of Education, Winneba, and Cape Coast Technical University. Alongside the public universities are 4 private universities, 11 training colleges and polytechnics, and 59 reputable senior high schools.

The region can boast of an economy dominated by services followed by mining and fishing. The economy is also based on an abundance of industrial minerals and tourism. Tourist attraction sites such as castles (Cape Coast and Elmina Castles), forts (Fort St. Jago in Elmina, Fort William at Anambah and Fort Good Hope at Senya) and beautiful beaches stretched along the coastline of the region. The core of these tourist attraction sites is the Kakum National Park that attracts people from across the country. There are about 32 major festivals in the region. Notable among these are the Aboakyer at Winneba, Fetu at Cape Coast and Bakatue at Elmina (GSS, 2013). The indigenes of Central region enjoy Etsew and Fante fante (fresh fish palm oil stew) as their main dish. However, Kenkey and Fufu are both eaten with a variety of sauces, stews, and soups. Seafood is commonly eaten across the Central Region.

The region has a population estimates of. 2,859,821 million representing 9.3% of Ghana's 30.8 million population. Out of the 2,859,821 million population in the region, 51.4% are females, while 48.6% are males (GSS, 2021). The region is divided into 22 MMDAs. Out of these, the region has 1 Metropolitan, 7 municipals and 14 districts. There are six hundred and sixty-one (661) Health facilities comprising of a Teaching Hospital, 1 Psychiatric Hospital, 1 University Hospital, 14 Hospitals, 13 District Hospitals, 14 Polyclinics, 73 Clinics, 69 Health Centers, 444 Community Health-based Planning Services (CHPS) zones, and 31 Maternity Homes in the region (Central Regional Health Directorate; Health Information Unit, 2021).

3.3 Inclusion and exclusion criteria

3.3.1 Inclusion Criteria

All maternal deaths that occurred in the Central Region between January 2019 and December 2021.

3.3.2. Exclusion Criteria

Maternal deaths that were not audited. Maternal deaths that were not audited at the regional level (partially audited). Audit reports that were not completely filled (missing information on any of the six variables of interest) were excluded from this analysis.

3.4. Sampling

A total enumeration of all completely filled maternal audit report forms over the period of study. Secondary data was used to generate the first part of the data, and an interview conducted using an interview guide. All mortality audits over the period (January 2019 to December 2021) were reviewed and included based on the inclusion and exclusion criteria. For the qualitative interviews, purposive sampling technique was used to select participants. A total of 14 health workers and managers were interviewed before data saturation was reached.

3.5. Variables

3.5.1. Dependent Variable

Maternal death was the dependent variable in the study. Further analysis was conducted to investigate maternal deaths that occurred following the three different modes of delivery (caesarean sections, vaginal delivery, and termination of pregnancies) and the factors that contributed to the deaths in each category.

3.5.2. Independent Variables

Independent variables were the six health system factors, the challenges were mainly delay in intervention, lack of equipment and consumables, lack of expertise inadequate knowledge and skills, inadequate human resources. Communication breakdown and transportation challenges.

3.6. Data Source and Collection

All fully completed audit reports of maternal deaths recorded in the Central Region between 1st January 2019 and 31st December 2021 were reviewed. Reports containing information on the variables of interest were included in the study.

Data were collected through manual review of information contained in, the audit reports and extraction of data according to a prespecified rubric containing demographic and clinical variables. Some health workers and managers were interviewed using a structured interview guide to obtain the needed information from them.

3.7. Data Analysis and Management

Microsoft Excel 13 and Stata Statistical Software IC 16 was used to capture the data and analyze it. The Microsoft Excel software was used to develop a template to capture data from the audit report forms. The data were cleaned and validated, after which a descriptive data analysis was done using Stata software. A multinomial logistic regression analysis was used to test statistics for associations between mode of delivery and the six identified health system factors. The data from the in-depth interviews were analyzed using thematic analysis approach.

3.8. Ethical Clearance

Ethical clearance for the study was sought from the Cape Coast Teaching Hospital Ethical Review Committee (CCTHERC) with Approval Reference Number (CCTHERC/EC/2022/180). Permission to collect data was sought from the office of the Regional Director of Health Services. Data was collected from the audit reports on an Excel sheet at the premises of the Regional Health Directorate on the principal investigator's laptop. The in-depth interview was conducted at the Central Regional Health Directorate after a maternal mortality audit. Information from the interview was handwritten in a notebook and later entered into a word document on the principal investigator's laptop. The collected data was password protected and kept in the possession of only the principal investigator as no research assistant was involved in the study.

CHAPTER FOUR

RESULTS

4.0. Introduction

This chapter presents the study's findings. Data analysis and comments are included in the chapter.

4.1. Data

Ninety-eight audit reports were analyzed out of a total of 204 deaths over the period of study.

4.2. Demographic Characteristics

Demographic characteristics aimed at collecting information on age at the time of death, parity including the last pregnancy or delivery, mode of delivery, highest educational level, occupation, religion, marital status, residence and place or facility in which the mortality occurred. Table 4.1 shows the demographic characteristics of the mortalities over the period of study.

From Table 4.1, out of the 98 maternal deaths analyzed, A larger proportion of the women 46 (47%) were between 20 and 29 years. Thirty-five (36%) were between 30 and 39 years of age whiles 12 (12.2%) were above the age of 39 years. Five representing 5.1% of the women were teenagers (10 to 19 years). From the data, more than 50% of maternal deaths occurred in young women below the age of 30 years. With regards to parity, 29 representing 30% of the women who died had either delivered their first child or were pregnant with their first child. 14 had delivered their second child, and 20 of them were pregnant with or had delivered their third child. 21 were pregnant with or had delivered their 4th child and 14 were pregnant with or had delivered more than 4 children.

Most of the women (50) representing 51% had caesarean sections. Forty-two representing 43% had a vaginal delivery and 6(6.12%) had a termination of pregnancy (all pregnancies ending before 28 weeks including ectopic pregnancies).

A significant number of the women who died had completed middle school or Junior high School (that is 44 representing 45%). Eleven of the women had no formal education at all, and the educational level of 13 of them was not known. Eleven of the women had tertiary education. Fifty-three, representing 54% of the mortalities lived in urban areas, and the remaining 46 % lived in rural areas.

Most of the women were traders 32 (33%), 19 of them were artisans, and 14 were unemployed. Twelve of the women were farmers and 7 were civil servants. Three of the women were housewives. The majority of the women were married, 72 representing 73%, with 15% being single or never married, and 11% were cohabiting. Eighty-nine representing 91% of the women were Christians with the remaining 9% being Muslims. None were traditionalists or of any other religion.

Most of the mortalities occurred in the district hospitals (61 representing 62%), 29% occurred at the Cape Coast Teaching Hospital and 9% occurred in lower-level facilities such as Polyclinics and Health Centers.

Table 4.1. Demographic characteristics of maternal mortalities in the Central Region (from January 2019 to December 2021)

	Frequency	Percentage (%)
Age (years)		
<20	5	5.10
20-29	46	46.94
30-39	35	35.71
>40	12	12.24
Total	98	100.00
Parity		
1	29	29.59
2	14	14.29
3	20	20.41
4	21	21.43

5	5	5.10
6	7	7.14
7	1	1.02
8	0	0.00
9	1	1.02
Total	98	100.00
Mode Of Delivery		
Caesarean Section	50	51.02
Vaginal Delivery	42	42.86
Termination Of Pregnancy	6	6.12
Total	98	100.00
Educational Level		
None	11	11.22
Primary School	10	10.20
Middle School/JHS	44	44.90
Senior High School	9	9.18
Tertiary	11	11.22
Unknown	13	13.27
Total	98	100.00
Residence		
Rural	45	45.92
Urban	53	54..08
Total	98	100.00
Occupation		
Unemployed	14	14.29
Artisan	19	19.39
Civil Servant	7	7.14
Farming	12	12.24
Housewife	3	3.06
Trade	32	32.65
Student	3	3.06
Others	8	8.16
Total	98	100.00
Marital Status		
Cohabitation	11	11.22
Never Married	15	15.31
Married	72	73.47
Divorced/Separated	0	0.00
Total	98	100.0
Religion		
Christian	89	90.82
Muslim	9	9.18
Traditionalist	0	0.00
Total	98	100.00
Place Of Delivery		
CCTH	28	28.57
District Hospital	61	62.24
Other Facilities	9	9.18
Total	98	100.00

4.3. Factors Contributing to Maternal Mortalities

Table 4.2 shows the results of the various factors contributing to maternal mortalities in the Central Region of Ghana.

From the Table, 60 representing 61% of the women who died were referred from one facility to another. The remaining 38 representing 39% of them were not referred (died in the facility where care was first sought or initiated). Thirty-five (35) of the women representing 36% delayed in seeking help. This includes having symptoms or danger signs of pregnancy and yet not reporting to the hospital or seeking spiritual and other interventions other than medical intervention at the hospital. From the reports, these delays contributed to the deaths of the women.

Nine (9.18%) of the women declined treatment or admission at the hospital. This included refusal of lifesaving surgical procedures, medications and blood transfusions. Four (4) of the mortalities had difficulty getting transportation from their homes to the hospital which contributed to their demise. In 9 of the cases transportation challenges could not be ascertained. However, 87% had no transportation challenges to the hospital.

Lack of transportation from one health facility to the other contributed to 13(13.27%) of the deaths. Transportation challenges included delays in securing ambulances, using other vehicles other than ambulances to convey sick patients to hospitals and breakdown of ambulances during transportation.

Health service communication breakdown contributed to 24 (25%) of the mortalities. This included not calling referral facilities before referring cases, not providing adequate information on patient's condition and providing inaccurate information about patients. Lack of equipment or consumables such as drugs, infusion sets, blood and blood products contributed to 41 (42%) of the mortalities. Lack or

inadequate human resource contributed to 22 (23%) of the mortalities in the region. This included lack of staff in areas like the laboratory, theatre and anesthesia services.

Delay in instituting interventions contributed to 58 (59.18%) of the maternal deaths. This was due to other factors such as financial constraints on the part of patient to procure some medications and pay for services that are not on insurance. On some occasions it was due to unavailability of the specialized services in most of the facilities, leading to a referral or movement of the patient from one facility to another to have the particular test or service provided. Thirty-seven (37) representing (38%) of deaths were contributed to by lack of expertise, inadequate knowledge and skills in managing critically ill obstetric patients.

Aside the delay in interventions which is the commonest contributory factor, lack of equipment and logistics contributed significantly to maternal deaths followed closely by lack of expertise, inadequate knowledge and skills.

Table 4.2. Factors contributing to maternal deaths in the Central Region.

Factor	Frequency	Percentage
Referral		
No	38	38.78
Yes	60	61.22
Total	98	100.00
Delay in seeking help		
No	63	64.29
Yes	35	35.71
Total	98	100.00
Decline treatment		
No	89	90.82
Yes	9	9.18
Total	98	100.00
Lack of transportation from home		
do not know	9	9.18
No	85	86.73
Yes	4	4.08
Total	98	100.00
Lack of transport between facilities		
not applicable	34	34.69

No	51	52.04
Yes	13	13.27
Total	98	100.00
Communication breakdown		
not applicable	32	32.65
No	42	42.86
Yes	24	24.49
Total	98	100.00
Lack of equipment and logistics		
No	57	58.16
Yes	41	41.84
Total	98	100.00
Inadequate human resource		
No	76	77.55
Yes	22	22.45
Total	98	100.00
Delay in instituting intervention		
No	40	40.82
yes	58	59.18
Total	98	100.00
Lack of expertise		
No	61	62.24
Yes	37	37.76
Total	98	100.00

4.4.1 Proportion of Maternal Deaths Attributable to Health System Related Factors

From Table 4.3, none of the mortalities had all the six health system factors as contributory factors. Out of the 98 deaths, 12 representing (12.25%) did not have any health system challenge contributing to the death (12.25%). Twenty-five (25) of the mortalities had one of the factors contributing, whiles 28 of the deaths had two factors contributing. Twenty-three (23) of the mortalities had 3 health system deficiencies contributing to the death. Five of the mortalities had 4 factors contributing whiles another 5 deaths had 5 of the factors contributing to the death.

Table 4.3. The proportion of the mortalities attributable to the six-health system challenges in the Central Region.

Number of factors	Frequency	Percentage (%)
6	0	0
5	5	5.10
4	5	5.10
3	23	23.47
2	28	28.57
1	25	25.51
0	12	12.25
Total	98	100.00

4.4.2 The magnitude of the contributions of the individual health system factors towards the maternal deaths

From Table 4.4, delay in instituting interventions contributed to most of the mortalities (58 out of 98) with lack of equipment and lack of expertise, inadequate skill and knowledge second and third highest contributors to mortalities respectively. Transportation challenges between health facilities contributed least to the mortalities (13 out of 98 mortalities).

Table 4.4. Health system challenges and their contribution towards maternal deaths in the Central Region.

Health system related factor	Number of deaths	Percentage (%)
Delay in instituting interventions	58	59.18
Lack of equipment and consumables	41	41.84
Lack of expertise, inadequate skill and knowledge	37	37.76
Health system communication breakdown	24	24.49
Lack or inadequate human resource	22	22.45
Lack of transport between health facilities	13	13.27

4.5. How the specific Health System challenges contributed to the Mortalities.

The third objective of the research was to examine the health system-related factors that contributed to maternal deaths in the Central Region. On the audit report form space is provided for comments on the specific reasons or occurrences that contributed to the maternal deaths. Some of the comments on the factors gathered from the forms were as follows:

Delay in Instituting Interventions

Some of the delays were due to a lack of knowledge and skills, and financial constraints to pay for services such as scans, x-rays, dialysis, ICU admissions, CT scans and some laboratory investigations. Sometimes patients were referred to other public or private facilities before these investigations could be provided.

Lack of Equipment and Consumables

From the reports, faulty ventilators, and anesthetic machines contributed to some mortalities. Lack of emergency medications such as magnesium sulphate and labetalol led to the deaths of some patients with hypertensive diseases during pregnancy. Some of the mortalities occurred due to the unavailability of blood and blood products.

Lack of expertise, inadequate knowledge and skills

Some complex cases were managed at facilities without specialists. Some cases became complicated on the theatre table at a point where referral was impossible, and the only remedy would have been an experienced hand in time.

Lack of or inadequate human resources.

Some essential services such as blood transfusion and surgeries were not available in some facilities at night because of low staff strength. Some interventions were withheld until the following day which ended up making the condition more

complicated. Some workers were on call at night, which caused a delay in instituting interventions.

Health service communication breakdown

Some of the incidents reported were as follows; Health workers in referring facilities did not call the referral centers before referring patients, and some called when the patients were already on their way to the referral centers. Some of the facilities failed to provide detailed information on the patient's condition. Some health workers in referral centers did not pick up calls from peripheral facilities, and some referral contacts were inactive.

Lack of transport between health facilities

Some patients were transferred inappropriately in vehicles where the needed care could not be provided. This was because of the unavailability and unaffordability of ambulance services. Some ambulance operators insisted on relatives paying for fuel before they moved to the referral center.

4.6. Further examination of the individual health system challenges

Relationship between the health system factors and mode of delivery resulting in maternal deaths

Table 4.5 summarizes the multinomial logistic regression analysis between mode of delivery and health system factors. It is evident from the Table that only, lack of experience ($p < 0.047$) and lack of human resources ($p < 0.031$) were significant variables in the multinomial logistic regression model. They were significant under caesarean section as a mode of delivery, implying that lack of expertise and human resource challenges significantly contributed to mortalities in patients who had caesarean sections. The other factors had $p > 0.05$ and hence did not contribute significantly to maternal deaths in patients who had caesarean sections.

None of the factors were statistically significant in patients who died after vaginal delivery and termination of pregnancy.

Table 4.5. Multinomial logistic regression analysis between mode of delivery and health system factors

Mode of delivery	Health system factors	coefficient	p-value
Caesarean section	Lack of expertise	3.011	0.042
	Delay in intervention	18.451	0.995
	Lack of human resources	2.949	0.031
	Lack of equipment	-1.436	0.262
	Communication breakdown	-0.060	0.941
	Lack of transport	0.215	0.783
	Constant	-22.636	0.994
Vaginal delivery	Lack of expertise	0.111	0.806
	Delay in intervention	0.113	0.802
	Lack of human resources	0.524	0.304
	Lack of equipment	-0.200	0.653
	Communication breakdown	-0.126	0.741
	Lack of transport	0.346	0.394
	Constant	-0.8752	0.294
Termination of pregnancy	Lack of expertise	-28.563	0.999
	Delay in interventions	-31.057	0.993
	Lack of human resources	30.947	0.992
	Lack of equipment	-2.961	1
	Communication breakdown	28.668	0.996
	Lack of transport	-30.177	0.991
	Constant	-42.408	0.997

4.7. Lack of expertise and place of death

From Table 4.6, 22 (75.86%) of the mortalities from the Teaching Hospital did not have lack of expertise as a contributory factor whiles 7 (24.14%) had. Also, 37 (61.67%) of the mortalities from the district hospitals did not have lack of expertise as a contributory factor and 23 (38.33%) had lack of expertise as a contributory factor. Lastly, 2 (22.22%) of the mortalities from polyclinics did not have lack of expertise as contributory factor and 7 (77.8%) had lack of expertise as a contributory factor to the mortality.

Table 4.6. Lack of expertise and place of death.

Place of death	Lack of expertise	Number of Deaths	Percentage of mortality at facility	Percentage of overall mortality
Teaching Hospital	Did not contribute	22	75.86	36.07
	Contributed	7	24.14	18.92
District Hospital	Did not contribute	37	61.67	60.66
	Contributed	23	38.33	62.16
Other Facilities	Did not contribute	2	22.22	3.28
	Contributed	7	77.78	18.92

4.8. Recommendations by managers and health workers to reduce maternal mortality in the central region

Fourteen (14) health workers and managers deeply involved in maternal mortality auditing in the central region were interviewed, they made the following recommendations as suggestions to help reduce or prevent maternal mortalities in the central region of Ghana. Their recommendations were grouped under three major headings.

Logistics, and Facility related issues,

Suggestions were made to build an ultramodern ICU (intensive care unit) at CCTH with more bed spaces to take care of critically ill patients. "The current ICU space with four beds and occasionally faulty ventilators serving the entire region and western region is woefully inadequate" (interviewee 4, doctor).

Some of the interviewees suggested that blood donation and release practices should be refined such that when blood is available in a particular facility, other nearby facilities in dire need of blood to save a woman's life can easily access the blood without delay. 'A digital platform to indicate blood availability, facilities where blood is available and replacement status will be extremely helpful'. '*A reform on blood donation and release will also reduce the time lost in chasing blood and blood products for patients' (interviewee 9, biomedical scientist).*

Managers should ensure that consumables are available at all facilities at all time. '*The keys to the storerooms should be made available even on weekends and nights so that when there is scarcity, those at the stores can be used at all times' (interviewee 6, midwife).*

Another recommendation was for facilities to get a fund or stock consumables that are not covered by health insurance and use them on patients in emergency situations before relatives are made to pay or refund. '*A lot of consumables including infusions are now cash and carry*' (interviewee 2, pharmacist).

Health Personnel Related Problems

It was recommended that more doctors and nurses from the region should be trained in obstetrics and gynecology, anesthesia and critical care nursing to reduce the delay in interventions and improve on the expertise in managing complex cases. Another recommendation was that highly skilled doctors, midwives and nurses should be distributed evenly to various facilities in the region to reduce referrals to teaching hospitals which usually delays interventions. Others suggested the region provides incentives for doctors and other health workers to stay in the region. *'Specialists and anesthetists prefer to stay in Accra where they get locum to make extra money, since that opportunity is rare in the central region, providing incentives will help in keeping them in the region' (interviewee 14, Doctor).* It was recommended that more experienced health workers should be made to provide services at nights since most of the mortalities occur at night with relatively inexperienced staff at post. It was suggested that accommodation should be provided for specialists and consultants close to the hospital for easy access. *'More doctors and anesthetist should be sent to facilities with high workload and mortalities to help reduce mortalities'* (interviewee 1, Administrator)

Some managers recommended compulsory training for health workers in the various facilities to improve on their skills in managing emergencies and critically ill patients. There was a suggestion to include private facilities in training programs to improve on their knowledge and skills. *'The current annual live saving skills (LSS) workshops invites only a few private facilities in the region'* (interviewee 5, midwife).

It was recommended that each facility should design protocols for the management of critically ill patients with the help of the obstetricians and gynecologists in the region. *'This will serve as a guide in the management of patients, an example is*

the adaption of the MOEWS (maternal obstetric early warning signs) charts in some facilities' (interviewee 10, doctor).

Some health workers and managers recommended rewards for facilities who have fewer mortalities and manage critically ill patients promptly to prevent deaths. *'An award for such facilities will motivate them to go the extra mile in preventing maternal deaths'* (interview 11, midwife).

Transport and communication challenges

Some managers and health workers recommended that Payment for fuel for ambulance should be deferred until after treatment. *'The cost of ambulance should be taken up by the regional health directorate or facility*' (interviewee 7, midwife).

A suggestion was made to create a social media platform mainly for referrals. *'Difficult cases can be thoroughly discussed on the page to provide the needed information that will aid patient care'* (interviewee 12, midwife).

CHAPTER FIVE

DISCUSSIONS

5.0. Introduction

This chapter explains the health system challenges that affect maternal mortality, the magnitude of these factors and how they contribute to maternal deaths. It also explains the recommendations by stakeholders on how to reduce maternal mortalities in the central region. The discussion compares the findings in the present study with earlier studies.

The research aimed at examining the health system factors contributing to maternal mortalities as reported in the mortality audit reports in the central region. Out of the 204 mortalities over the period of study (2019 to 2021), 98 audit reports were suitable for analysis representing 48%. This was due to the fact that some of the mortalities were not audited, some audited reports were not sent to the regional health directorate, some audited reports were not completely filled whiles others were not clear enough to be read and analyzed.

5.1. Proportion of maternal deaths attributable to health system challenges

The first objective was to estimate the proportion of maternal deaths attributable to health system challenges in the central region. Six health system challenges were captured in the mortality audit reports. These were;

1. Lack of transportation from one health facility to another during referrals.
2. Health service communication breakdown during referrals and handing over of patients.
3. Lack of equipment or consumables.
4. Lack or inadequate human resources.
5. Delay in instituting interventions and

6. Lack of expertise and lack of adequate knowledge and skill

From Table 4.3, only 12 of the mortalities representing (12.25%) had no health system challenge or challenges as a contributory factor**.** This implies that 87.75 % of the deaths had at least one health system challenge contributing to the death. By extension 87.25% of the maternal mortalities could have been prevented if all health system challenges were eliminated. In a nationwide facility-based retrospective cohort study on maternal audit reports of 1060 deaths between January 2009 and 2013 in Rwanda, findings were similar. Factors related to provision of substandard care were identified for 61.1% of the cases, whiles 30.3% were due to patient and community related factors. The remaining 8.6%, did not have any identifiable contributory factor that led to the maternal death.(Sayinzoga et al., 2016).

5.2. Health system factors contributing to maternal deaths

The second objective was to identify the health system factors contributing to maternal deaths in the central region. From the audit reports reviewed, out of the 98 deaths, 86 had health system factors contributing.

The factors were as follows: Delay in instituting interventions: this factor contributed to 58 (59.18%) of the mortalities. It was the factor that contributed the most to the mortalities in the region. This implies that about 60 percent of maternal deaths could have been prevented if interventions were timely. In a similar study by Mahmood, delay in procedures such as hysterectomies contributed to 7 out of the 30 maternal deaths studied representing 23% (Mahmood et al., 2021). Unlike what Mahmood found, this study found that the delay in interventions was a major factor contributing to about 60% of maternal deaths.

The second commonest contributor to maternal deaths in the region was lack of

equipment and consumables. This factor contributed to 41 (41.84%) deaths over the period of the study. A significant number of deaths can be prevented by providing the necessary equipment and consumables in our health facilities. This finding is similar to findings in a systematic review paper on the third delay by Knight et al. Challenges relating to the availability of essential drugs, equipment and blood were cited in 38 articles out of a total of 43 articles. Twenty-two articles referred to total lack of essential equipment such as surgical equipment and vacuum aspirator pumps, as well as more basic equipment such as surgical gloves and cannulas. Six articles made reference to broken down or poorly maintained equipment. Lack of safe blood supplies for transfusion was also a major problem identified in 13 articles.

In a tertiary hospital in Nigeria, over 20% of the maternal deaths were attributable to delays in acquiring blood (Knight et al., 2013).

The next important contributory factor was the lack of expertise, inadequate knowledge and skills. The knowledge and skill gap among health care workers in the region contributes significantly to maternal deaths. This factor contributed to 37 (37.76%) deaths in the region. In a similar study by Mahmood et al, it was revealed that in 16 out of the 30 maternal deaths, studied, inadequate knowledge and skills contributed to the deaths. and for 13 out of these 16 deaths, health care workers did not follow evidence-based best practice (Mahmood et al., 2021).

The fourth commonest contributory factor was health service communication breakdown which contributed to 24 (24.49%) of the mortalities. Communication gaps between facilities and health workers was a defect in the health system which contributed to approximately a quarter of the mortalities in the region. In a systematic review paper on the third delay, five articles reported that communication was a challenge because of the lack of radios and telephones or non-functioning radios and

telephones. In this study, reasons for communication challenges were similar with inactive referral numbers being one of the commonest (Knight et al., 2013).

Lack or inadequate human resource as health system challenge contributed to 22 (22.45%) of the mortalities in the region. The inadequate numbers coupled with poor distribution of health workers in the region contributed to more than 20% of maternal deaths. Compared to findings from a similar study in Indonesia published in 2021, inadequate staff numbers were not a major challenge. Only 3 out of 30 women (10%) did inadequate staff numbers contribute to delays and/or inadequate management leading to the mortality (Mahmood et al., 2021).

The health system factor that contributed the least to the mortalities was lack of transportation between health facilities. This challenge contributed to 13 (13.27%) deaths in the region. In a systematic review article on the third delay by Knight et al, twelve of the 16 articles that highlighted referral-related problems reported that inadequate emergency transport contributed towards maternal mortality. Some of the reasons cited were: the ambulance - had broken down without any replacement, or was under-staffed and ill-equipped, Unavailability of Car ambulances in some districts (only 7–31% of facilities in three districts of Malawi had car ambulances). Delays occurred in three of the papers because the ambulance had no fuel which meant that the woman's relatives had to be sent to purchase fuel (Knight et al., 2013). In this study, the main reason given for the transportation challenges was the inability of the woman's relatives to pay for fuel before the referral.

About 60% of the mortalities could have been avoided if interventions were timely. The lack of equipment and consumables was the second leading contributory factor to maternal mortality in the central region and this was closely followed by lack of expertise inadequate knowledge and skills. These factors were however interrelated

and could be addressed comprehensively by addressing the fundamentals of health system strengthening using the WHO six building blocks.

5.3. The specific health system challenges affecting maternal deaths

The third objective of this research was to examine the health system-related factors contributing to maternal deaths in the Central Region. The audit report form provided spaces for comments on the specific reasons or occurrences that contributed to the maternal death to be written. However, only a few of the incidents or reasons were written on the forms. From the information gathered from the forms. Some of the comments on the factors were as follows;

5.3.1 Delay in Instituting Interventions

Most of the delays were due to a lack of knowledge and skills, and financial constraints to pay for services such as Scans, X-rays, Dialysis, ICU admissions, CT scans, and some laboratory investigations. These investigations and interventions are critical in managing severely ill patients. Delays in retrieving some of the above reports made decision-making extremely difficult and delayed interventions. Expansion of the health insurance schemes coverage of the above services for critically ill patients will help prevent many deaths. In similar research conducted by Aggarwal et al, third-level delay at facilities due to lack of equipment, medications, instruments, and unavailability of blood and blood products in referral facilities ranged from 7.6 to as high as 68.2% contributing to maternal near misses (Aggarwal et al., 2012).

In a study conducted in a regional hospital in Ghana, delay in intervention contributed to 4 out of the 33 mortalities reviewed (12.1%), compared to 59.18 % of this study. This wide difference could be due to the fact that the research was a facility based and hence delays in transportation and referrals which invariably delays intervention were eliminated (Adusi-Poku et al., 2015). Factors such as lack of expertise which also affect the promptness of interventions will be

minimal since it was done at a regional hospital where more experienced personnel are available to guide the inexperienced ones.

In a study by Issah et al in the Upper West Region of Ghana, 49.5% of the deaths (46 out of 93) occurred within 24 hours after admission. This clearly highlights that emergency response systems, proper use of antibiotics, and prompt provision of blood transfusions were not adequate. The inadequacy of the emergency response systems were more pronounced during the night shift as nearly half of PPH patients (5 out of 11) and over 60% (7 out of 11) of anemia patients died during this period (Issah et al., 2013). This finding is closely linked with inadequate human resources where a skeleton staff manages the entire facility at night and hence are overwhelmed when these complicated cases arrive at night.

5.3.2. Lack of Equipment and Consumables

From the audit reports, faulty ventilators, and anaesthesia machines contributed to some mortalities. Lack of emergency medications such magnesium sulphate and labetalol led to deaths of some patients with hypertensive diseases in pregnancy.

Some of the mortalities occurred due to unavailability of blood and blood products. This was the commonest consumable lack that contributed to mortalities. In a systematic study by Merali et al poor blood transfusion capacity was found to be a contributory factor in 47.7% of the audit reports reviewed (Merali et al., 2014).

These facility-based challenges caused a lot distress to health workers and serve as a source of major setback in attempts to treat critically ill patients and save lives. Challenges with equipment and consumables were sometimes due to inaccessibility of

the consumables and not unavailability. During night shifts and weekend duties, occasional shortages of consumables occur because of lack of access to those at the storeroom.

In a similar study in the Eastern Regional Hospital between January and December 2012, 37 audited maternal reports were reviewed and it was found that out of the total referred cases, 19% were brought in critical conditions and needed to be managed in an intensive care unit, yet they received normal medical care on the wards. This was due to the lack of the ICU facility in the hospital. I the same review seventy two percent (72%) of those who needed blood had at least one unit of blood, however only 16% received the full quantities of prescribed blood (Owusu-sarpong et al., 2017). The lack of equipment and consumables contributes significantly to the delays in instituting optimum interventions in numerous cases of maternal deaths and near misses.

5.3.3. Lack of Expertise, Inadequate Knowledge and Skills

Some complex cases were managed at facilities without specialist. Some cases became complicated on the theatre table at a point where referral was impossible and the only remedy would have been an experienced hand in time. This is sometimes due to specialist and consultants staying far away from the hospital or lack of specialists in some major hospitals in the region.

This challenge is also attributed to poor distribution of highly skilled professionals in the region leading to only a few or none of such experienced personnel in remote areas. Even in the same facility, relatively inexperienced and less skilled workers are made to do night and weekend duties which makes the handling of complex cases during those shifts' problematic. Whiles there may be staffs with the requisite

knowledge and skill to manage a particular complex case, the person may not be available at the time that his or her expertise is needed. In a similar study conducted by Mahmood et al in Indonesia, amongst 16 out of the 30 cases of maternal deaths reviewed, inadequate knowledge and skills were among the contributory factors; and for 13 out of these 16 deaths there was failure to follow evidence-based best practice (Mahmood et al., 2021).

In this study, 37.7 % of the deaths were associated with lack of expertise. This study however did not specify the level of expertise of the health professionals who managed the patients. A similar study by Adusi-poku et al, reviewed the level of experience of the clinicians who attended to the cases. It was found that, 85% of the cases were seen by senior clinicians – specialists 25(75.8%) and senior medical officers, 3(9.1%) respectively; four, 4 (12.1%) of them were not seen by senior clinicians (Adusi-Poku et al., 2015). The study was however conducted in a regional hospital setting which will have more experts on the ground to managed complex cases compared to a regional based study.

This finding (37.7 % of the deaths were associated with lack of expertise) is again similar to findings from a systematic review on avoidable factors contributing to maternal and perinatal deaths involving 39 studies that reviewed 6205 audited maternal deaths.in the study, Health care worker-oriented factors were the most common category of factors among the top 10 factors, accounting for six out of ten factors. Substandard health worker practice was responsible for the most deaths (688 deaths), and it was estimated that this factor contributed to 28.5% of the deaths in datasets where it was identified as an avoidable factor (Merali et al., 2014). Lack of expertise and inadequate knowledge and skills as captured in the audits reports reviewed leads to substandard care with the possibility of causing maternal deaths.

5.3.4. Lack or Inadequate Human Resource

Inadequate human resources contributed to 22.5% of maternal deaths in the central region compared to a similar study conducted at Indonesia which found this challenge contributed to only 10% of the mortalities (Mahmood et al., 2021). Some essential services such as blood transfusion and surgeries are not provided in some facilities at night because of the low staff strength. Some facilities have to call individuals from home when there are emergencies to come and help out, which delays intervention. Some interventions were withheld until the following day which ended up making the condition complicated and contributing to mortalities.

Issah et al, 2013 looked at Hospital work shifts and days of the occurrence of maternal deaths in 6 hospitals in the Upper West Region of Ghana. It was found that some causes of maternal death were linked with hospital work shifts. The highest number of deaths (n=39) occurred on the night shift. It is also during the night shift that 7 out of 11 deaths due to anemia and 5 out of 11 deaths due to PPH took place. These are critical conditions that require various sections to function together to prevent maternal deaths. The study found that blood banks, theatres, and pharmacy services were open fully and staffed during the morning shift. However these 3 service delivery areas were manned by skeleton staff during the night sometimes the personnel have to be called from their homes to open the facilities and provide services to emergency cases (Issah et al., 2013). If all major health facilities could run a 24-hour full service, a lot of interventions would be timely, and this will reduce maternal deaths. This can only be possible with enhanced human resource across all the clinical disciplines.

5.3.5. Health Service Communication Breakdown

Some of the incidents reported were; health workers in referring facilities not calling the referral centres before referrals, calling whiles the patient is already on her way to the referral centres and not providing adequate information on the patients' condition. Health workers in referral centres not picking up calls from peripheral facilities and keeping inactive phone lines at referral sites.

This leads to poor preparation and subsequently poor management of patients upon referral. This also delays referrals leading to a delay in instituting appropriate interventions.

5.3.6 Lack of Transport between Health Facilities

Transportation challenges on a few occasions delayed referrals and interventions. Lack of ambulance meant some patients were transferred inappropriately in inappropriate vehicles where the needed care could not be provided. This could be live serving resuscitation or oxygen therapy which may contribute to maternal death or morbidity. Some ambulance personnel insisted on relatives to pay for fuel before ambulances are moved which causes a lot of delays. Some of these delays contributed to maternal deaths in the region. In a study conducted in the upper east region of Ghana, transportation delays was a major contributory factor in maternal deaths with the lack of ambulances being a major cause of delay in transporting patients from CHIPS compounds to the district Hospitals (Awoonor-williams, 2018).

In a study conducted by Lee et al, at the Komfo Anokye Teaching Hospital (KATH), One hundred and forty (43.5%) of all women who died were referred from other health facilities, such as district hospitals, maternity homes and health centres, while the remaining 56.5% were walk-in cases. Out of these more than half (57.1%) of maternal deaths occurred within 24hours of admission. Four mothers were brought in dead and another 32 died within three hours of admission. (Lee et al., 2012). This could be due to two main challenges, transportation challenges or late referrals. When a critically ill patient is transported inappropriately, the outcome is likely to be poor and hence high numbers of brought in dead and deaths within 3 hours of arrival to the referral centre.

In a systematic review on avoidable factors contributing to maternal and perinatal deaths involving 39 studies that reviewed 6205 audited maternal deaths between 1966 and 2011. The most common factors reported overall were patient and transport delays, each of which was a reported factor in 52.3% of the datasets (Merali et al., 2014). Transport challenges have improved significantly over the years due to modernization and urbanization and hence the lower levels of this factor contributing to maternal deaths in recent times.in this study transportation challenge contributed to 13.27% which is still high considering that this study was conducted on mortalities that occurred in the central region as recent as between January 2019 and December 2021.

5.4. Mode of delivery and the health system factors

An analysis was done to assess whether these six health system factors influenced maternal deaths with respect to the different modes of deliveries considered. This is because different skill set and personnel are required in managing patients going through the different modes of delivery. It was evident from table 4.5 that only, lack of expertise (p-value = 0.047) and lack of human resources (p-value = 0.031) were

significant variables in the multinomial logistic regression model. They were significant under caesarean section as a mode of delivery, implying that lack of expertise and human resource challenges significantly contributed to mortalities in patients who had caesarean sections. None of the factors were statistically significant in patients who died after vaginal delivery and termination of pregnancy.

Caesarean sections are usually performed for more complicated deliveries and requires lots of personnel and skills from anaesthesia, surgery and resuscitation skills. Therefore, the likelihood of having an inadequate skill and inadequate human resources contributing to mortality is higher compared to vaginal delivery and termination of pregnancies. Caesarean delivery requires more extensive preparation and the need to get more members from other disciplines such as surgeon, anaesthesia, theatre nurses, etc on board. Assembling this team may be difficult and commonly delays which sometimes contributes to mortalities that happen during or after the surgery. Merali et al, in a systematic review of 39 studies on maternal deaths revealed that delayed operative delivery was found to be a cause of maternal death in 27.3 % of the deaths reviewed (Merali et al., 2014).

In this study, lack of expertise contributed to as much as 37.76% of the mortalities in contrast to a similar study conducted by Mahmood et al, only in one case out of the 30 (3.3%) did it appear that the staff at the bedside might have benefitted from advice from a senior staff member with more expertise (Mahmood et al., 2021).

Upon further analysis, 22 (75.86%) of the mortalities from the teaching hospital did not have lack of expertise as a contributory factor whiles 7 (24.14%) had. This had the least contribution of lack of expertise to maternal deaths compared to the other levels of care. 37 (61.67%) of the mortalities from the district hospitals did not have lack of expertise as a contributory factor whiles only 2 (22.22%) of the mortalities from

polyclinics did not have lack of expertise as contributory factor. This implies that a higher percentage of the mortalities in the lower levels of care were due to lack of expertise. This could be due to poor distribution of experts and experienced personnel to lower-level facilities or delay in referring patients who need expert care to higher facilities.

5.5. Recommendations by Stakeholders to Reduce Maternal Deaths

The last (fourth) objective was to explore the views of health workers and managers on strategies and measures to address the health systems factors which contribute to maternal mortalities in the central region. Eighteen separate recommendations were proposed from the managers and health workers. The recommendations have been grouped under three headings, these are: health facility related challenges, health personnel related problems and Transport and communication challenges.

Similar research done in the western region in 2014 where analysis of institutional maternal death audit reports was conducted. It was gathered from the reports that 37% of the recommendations were on timely interventions, 25% on staff training, 13% on the provision of logistics, and 11% on improved communication. Improvement in transport featured in only 3% of the recommendations. Improved counselling was found to be 11% (Ivanova et al., 2016). Although this study used a qualitative approach in obtaining recommendations from health workers and managements. The themes of the recommendations are similar to what was found in the study conducted in the Western region.

5.5.1 Health Facility Related Challenges

Suggestions were made to build a new ICU (intensive care unit) at CCTH with more bed spaces to take care of critically ill patients. This will go a long way to help save many lives since an ICU facility takes care of critically ill patients who require intensive care to survive.

A reform on blood donation and release practices as suggested by some health workers and managers will go a long way to reduce morbidities and mortalities by reducing delays on some live saving intervention. Making keys to the store rooms available all the time even on weekends and nights will help to prevent the acute shortages that occurs during these shifts. Another recommendation was for facilities to get a fund or stock consumables that are not covered by health insurance and use them on patients in emergency situations before relatives are made to pay or refund. If this suggestion is put into practice, it will help to reduce a lot of delays in instituting interventions.

5.5.2 Health Personnel Related Problems

Recommendations were made for more doctors and nurses from the region to be trained in obstetrics and gynaecology, anaesthesia and critical care nursing to reduce the delay in interventions and improve on the expertise in managing complex cases. Another recommendation was that highly skilled doctors, midwives and nurses should be distributed evenly to various facilities in the region to reduce referrals to teaching hospitals that delays interventions. Others suggested the Region provides incentives for doctors and other health workers to stay in the region.

The above recommendations will improve on the human resource in-terms of quality and quantity. This will help to reduce the workload on staff and also reduce mistakes that leads to morbidities and mortalities.

It was recommended that more experienced health workers should be made to provide services at nights since most of the mortalities occur at night with relatively inexperienced staff at post.

It was suggested that accommodation should be provided for specialists and consultants close to the hospital for easy access. Emergencies come unexpected and sometimes, without the requisite skills and experience, there is the likelihood of a delay in instituting the right treatment which can lead to a mortality. Highly skilled and experienced personnel at the facility at all times will help reduce mortalities from such scenarios.

One of the recommendations was to send more doctors and anaesthetist to facilities with high workload and mortalities to help reduce mortalities. These facilities may not be attractive to health workers for one or two reasons. Therefore, incentive packages can be instituted to make those facilities attractive so that more health workers will accept postings there to improve on healthcare delivery in these facilities.

Some managers recommended compulsory training for health workers in the various facilities to improve on their skills in managing emergencies and critically ill patients. There was a suggestion to include private facilities in training programs to improve on their knowledge and skills. A lot (37%) of the mortalities were due to lack of expertise, inadequate knowledge and skills. These mortalities could be prevented if staff across the region are made to go through training workshops frequently to improve on their knowledge and skills in managing obstetrics and gynaecological emergencies. These training sections could empower facilities and guide them to design protocols for the management of critically ill patients which is suited for the facility. The current LSS (live saving skills) workshop conducted annually could be enhanced and made more frequent so that all health workers in all facilities can go benefit from the training.

Some health workers and managers recommended rewards for facilities who have fewer mortalities and manage critically ill patients promptly to prevent deaths. This if well organized under fair conditions will motivate health workers and facilities to go the extra mile to make sure clients receive the best of care.

5.5.3 Transport and Communication Challenges

Some managers and health workers recommended that Payment for fuel for ambulance should be deferred until after treatment. In some instances, demand for money to fuel the ambulance causes delay in transporting the patient to the referral centre. This delay may worsen the condition of the patient and make treatment more complicated leading to mortality. If the cost is taken up by the regional health directorate or facility as suggested by some health workers and managers, a lot of delays could be avoided.

Another suggestion was to create a social media platform mainly for referrals such that difficult cases are thoroughly discussed on the page to provide the needed information. This will definitely improve on communication between health workers and facilities and improve on service delivery. It is also likely to reduce a lot of delays in referring patients and hence reduce mortalities.

Some of the recommendations will require support from the central government and the ministry of health. This support may include to change policies and provision of aid in the training of skilled personnel. Provision of financial support to improve on infrastructure specifically an ultramodern ICU in the central region and taking up of the initial cost of dialysis would help reduce mortalities significantly.

Some of the recommendations have already been initiated by the regional health directorate, an example is the yearly LSS (live saving skills) program that has been instituted to train health workers in the management of obstetric emergencies and

acquiring live saving skills in the region. Others can be taken on board by the directorate to improve on maternal health.

Some of the recommendations can be taken up and implemented at the facility level. These suggestions could be helpful in reducing the maternal mortality rate in the facilities, districts and central region at large.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.0. Introduction

This chapter summarizes the key findings from the three-year audit report review of maternal mortalities in the central region, and recommendations made by stakeholders to prevent avoidable maternal death (s). It also contains the conclusion recommendations and limitations of the study.

6.1. Summary of Findings

The results of the analysis of the audit reports were used to form the basis of the research. An interview was conducted based on the information gathered from the audit reports to seek for solutions to the challenges identified from the stakeholders' vest in the field. Only 12.25% of the mortalities were not attributable to any health system factor. It was gathered that a health system challenge or challenges contributed to as high as 87.25% of the mortalities.

The challenges were mainly delay in intervention, lack of equipment and consumables, lack of expertise inadequate knowledge and skills and inadequate human resource. These factors were interlinked and a solution in one could affect the others positively and reduce mortalities. Communication breakdown and transportation challenges also contributed to some of the mortalities.

None of the deaths had all six factors contributing but some had as high as 4 and 5 factors contributing. It was established that lack of expertise, inadequate knowledge and skills, and inadequate human resources contributed significantly to mortalities in women who had cesarean sections. It was again established that a higher percentage of the mortalities in the lower levels of care were due to lack of expertise.

Several recommendations were provided by health workers and managers that could help prevent mortalities when practiced.

6.2. Conclusions

Health system challenges contributed significantly to the maternal mortalities in the central region. The various health system deficiencies were identified and documented by the experts in the audit reports. The health system challenges contributed to mortalities regardless of the mode of delivery and place of death. Lack of expertise and inadequate human resources contributed significantly to mortalities in women who had caesarean sections. Lack of expertise affected mortalities at the lower-level facilities compared to the Teaching Hospital. Recommendations on how to prevent mortalities in the region were provided by the experts and stakeholders.

6.3. Recommendations/ Remarks

Mortality audits should continue and enhanced with provision of more details to serve as a source of reliable information on maternal health in the future. Stake holders should be encouraged to completely fill the forms to provide concrete information on maternal mortalities.

Record keeping should be enhanced to provide relevant information on the factors and possible solutions to the high maternal mortality ratio in the region and the country at large.

Health system challenges should be eliminated to reduce maternal mortalities in the region. Challenges such as lack of expertise and inadequate human resources should be prioritized since they contributed significantly to maternal deaths in the region.

Improvement in the knowledge and skills of health workers in the region as well as increasing the number of experts in the field of maternal care will significantly reduce maternal mortalities in the region.

Detailed information on specific occurrences leading to mortalities are captured in mortality report which can be helpful in planning and instituting interventions to help reduce maternal deaths.

The various recommendations by the experts and stakeholders in the field can be discussed broadly by the Ghana Health Service (GHS) and Ministry of Health (MOH) and implemented to reduce maternal deaths. There is the need for further review of mortalities in the region and planning based on the findings to address local factors contributing to maternal deaths in the central region.

6.4. Study Limitations

The study's shortcoming was the unavailability of all the mortality audit reports for the study period. There were incomplete entries on some of the available reports rendering them unsuitable to be included in the analysis. Some printed and photocopied documents were too faint and unreadable and hence not included for the analysis. The above limitations reduced the sample size to 48% of the expected.

Details were not provided for some of the occurrences that contributed to the mortalities which did not provide conclusive evidence on the exact occurrence with individual health system factors.

6.5 Future Research

The research did not include health system factors attributable to maternal near misses. Maternal near misses are more common and a future prospective study directed towards that will reveal a lot of the system challenges in the Ghanaian Health Care System.

Additional Research with increased sample size can inform program design and implementation to help accelerate the reduction of maternal mortality ratio in Ghana.

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APPENDIX I

number
and the date of this
Letter be quoted

Our Ref.: CCTH

Your Ref.:

Cape Coast
CC-071-9967
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12th December, 2022

Dr David Walawah
School of Public Health
College of Health Sciences
University of Ghana

Dear Sir,

ETHICAL CLEARANCE – REF: CCTHERC/EC/2022/180

The Cape Coast Teaching Hospital Ethical Review Committee (CCTHERC) has reviewed your research protocol titled, '**Assessing the Health System Factors Affecting Maternal Mortality in the Central Region**' which was submitted for ethical clearance. The ERC is glad to inform you that you have been granted provisional approval for implementation of your research protocol.

The CCTHERC requires that you submit periodic review of the protocol and a final full review to the ERC on completion of the research. The CCTHERC may observe or cause to be observed procedures and records of the research during and after implementation.

Please note that any modification of the project must be submitted to the CCTHERC for review and approval before its implementation.

You are required to report all serious adverse events related to this study to the CCTHERC within ten (10) days in writing. Also note that you are to submit a copy of your final report to the CCTHERC office.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours sincerely,

Dr. Stephen Laryea
Medical Director
For: Chairman ERC