

UNIVERSITY OF GHANA

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DEPARTMENT OF EPIDEMIOLOGY AND DISEASE CONTROL

**FACTORS ASSOCIATED WITH PERINATAL MORTALITY AMONG REFERRED
OBSTETRIC EMERGENCIES IN THE ACCRA AND TEMA METROPOLITAN**

AREAS, GHANA

BY

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DECLARATION

I, PAUL BOATENG, hereby declare that this is my own research work. I have not presented it, either in part or whole, to this University or any other for another degree. The works of others have been duly acknowledged.

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DEDICATION

This work is dedicated to all friends and loved ones.



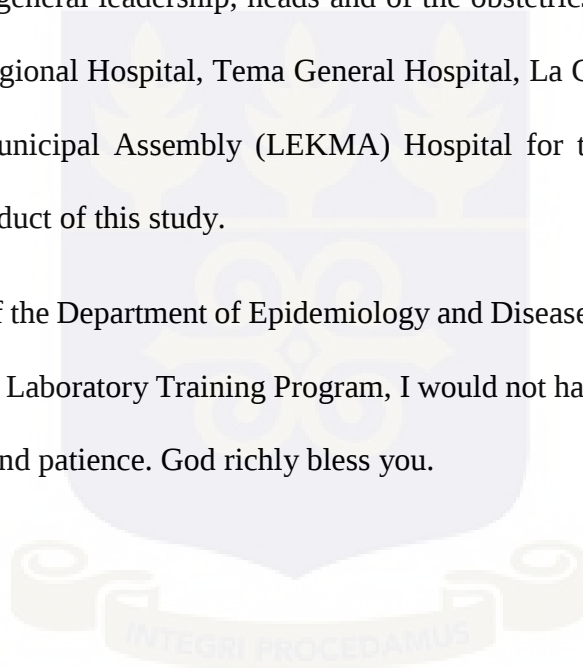
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ABSTRACT

Background

Perinatal mortality rate (PNMR) in developing countries, particularly sub-Saharan Africa and Ghana is unacceptably high. Most perinatal mortalities (PNM) occur among women referred for obstetric complication. Maternity referral system (MRS) challenges limit access to emergency obstetric care (EmOC) needed to prevent maternal and perinatal mortalities. Despite the importance of MRSs, they have been understudied and under researched. This study thus sought to find factors associated with PNM among referred obstetric emergencies in the Accra and Tema Metropolitan Areas, Ghana.

Methods

This research was a descriptive cross-sectional study conducted at four secondary level health facilities within the two metropolitan areas. Data was collected by interviewing mothers referred to these hospitals on account of obstetric emergencies or their caregivers with multiple data verification procedures. The data collection tool used was a structured questionnaire. Data was obtained from 240 respondents, entered into SPSS v22 and analysed using STATA version 14. Univariate analysis, simple logistic regression and multivariate logistic regressions were carried out to determine factors associated with PNM.

Results

Most of the respondents (38.3%) were referred on account of Pregnancy Induced Hypertension (PIH). About 17% were referred for non-clinician reasons, most due to non-availability of a doctor/ midwife. Most referred clients were unaccompanied by a health worker (55.0%) and no prior notification was given to the receiving facility (70.8%), although most came with referral letters (92.7%). Perinatal mortality rate was high (21.7%). On simple logistic regression, means of transport, accompanied by health worker (HW), marital status, number of

Ante-natal care (ANC) attendance, birth weight, gestational age and antepartum haemorrhage were found to be significantly associated with PNM ($p < 0.05$). On multivariate logistic analysis, the following independently reduce the odds of PNM: not accompanied by HW (AOR=0.32; 95% CI; 0.12-0.85), ANC visits of four or more times (AOR=0.11; 95%CI; 0.04-0.28) and not referred on account of antepartum haemorrhage (APH) (AOR=0.12; 95% CI; 0.05-0.32).

Conclusion

Referral guideline adherence is poor. Prevalence of PNM among referred obstetric emergencies is high. APH, low ANC visit and accompanied by HW increase the odds of PNM. There is the need for a review of the current referral guidelines by the Ministry of Health to help address current challenges. Clinicians must attend quickly and have a low thresh-hold for lifesaving interventions for referred emergencies with APH, accompanied by a HW and with poor ANC attendance record. Further research on referral systems and their role in determining perinatal outcomes are needed.

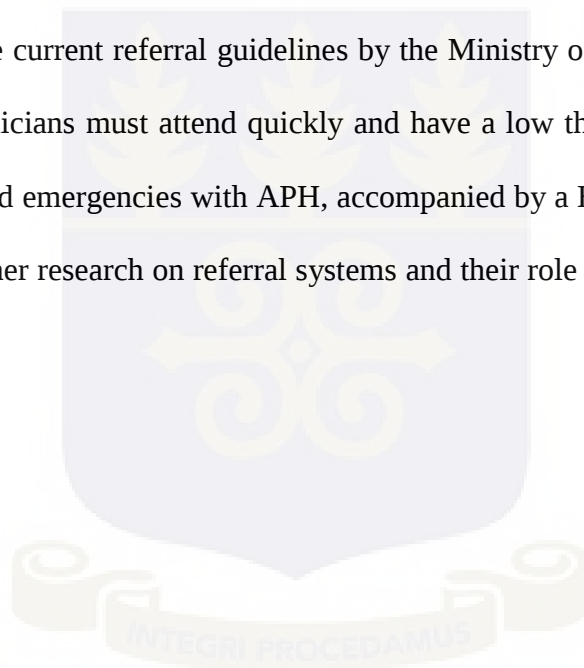


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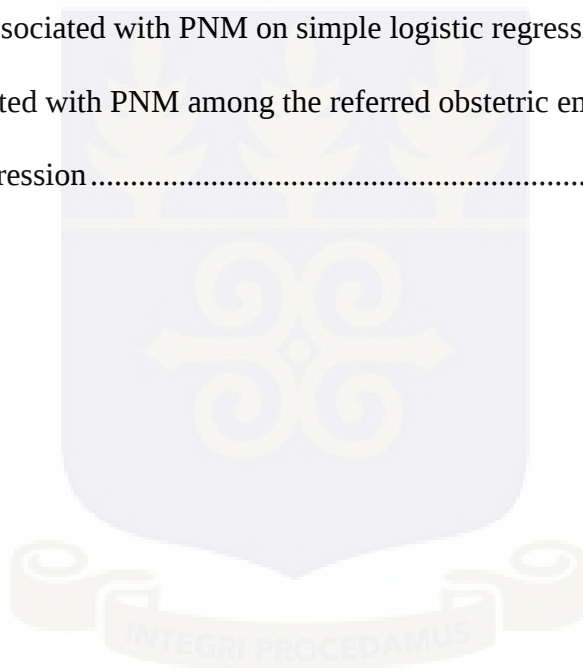
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LIST OF ABBREVIATION

AOR- Adjusted Odds Ratio

ARR- adjusted relative risk

C/S or C.S- Caesarean section

CEmOC- Comprehensive Emergency Obstetric Care

CHAG- Christian Health Association of Ghana

CI- confidence interval

COR- Crude Odds Ratio

EmOC- Emergency Obstetric Care

EmONC- Emergency Obstetric and Neonatal Care

GHS- Ghana Health Service

HF- Health Facilities

HW- Health Workers

IRR- Incidence Rate Ratio

LEKMA- Ledzorkuku Krowor Municipal Assembly

PNM- Perinatal mortality

PNMR- Perinatal mortality rate

TBAs- Traditional Birth Attendants

WHO- World Health Organization



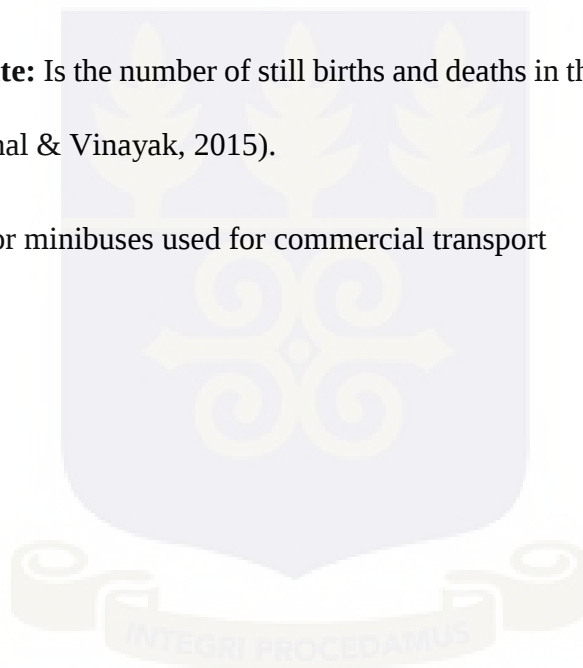
LIST OF DEFINITIONS

Obstetric emergency: Is a life threatening condition related to pregnancy or delivery, requires urgent medical or surgical intervention (within 24 hours) in order to prevent the likely death of the woman or fetus (Goud, 2014).

Perinatal Mortality: Late foetal deaths at 28 weeks gestation or more and early neonatal deaths within 7 days of live births (follows WHO recommendations in the 10th Edition of International Classification of Diseases) (Brahmanandan, Murukesan, Nambisan, & Salmabeevi, 2017).

Perinatal Mortality Rate: Is the number of still births and deaths in the first week of live birth per thousand births (Behal & Vinayak, 2015).

‘Trotro’: Local name for minibuses used for commercial transport



CHAPTER ONE

INTRODUCTION

1.1 Background

Perinatal mortality involves late foetal deaths at 28 weeks gestation or more (stillbirths) and early neonatal deaths within 7 days of live birth (early neonatal death) (Brahmanandan et al., 2017). Perinatal Mortality Rate is the sum of the number of foetal deaths of 28 weeks or more gestational age and the number of new-borns dying within the first week of life in a specified geographic area divided by the number of births over the same period and geographical area expressed per 1000 births (World health organization, 2006). The risk of death in the perinatal period is higher than all other ages (Yirgu, Molla, Sibley, & Gebremariam, 2016).

Globally, over 3.3 million stillbirths and 3 million early neonatal deaths occur each year. In 2000, over 6.3 million perinatal deaths were recorded worldwide: ninety eight percent of these deaths occurred in developing countries (World Health Organization, 2006).

The perinatal mortality rate (PNMR) in developing countries is five times higher compared to developed countries. The PNMR for developed countries is 10 deaths per 1000 births, 50 per 1000 births in developing countries and above 60 per 1000 in least developed countries. Africa has the highest PNMR, estimated at about 62 deaths per 1000 births. Within Africa, PNMR is highest in Western and Central Africa, with PNMR as high as 75 and 76 per 1000 births respectively (Khanam et al., 2017).

Ghana has a high perinatal mortality rate like other Sub-Saharan African countries. According to the Ghana Demographic and Health Survey 2014, the PNMR of Ghana stands at 38 per 1000 births (Ghana Statistical Service, 2015). The PNMR is marginally higher in urban than in rural areas of the country. The Greater Accra Region has one of the highest perinatal mortality rates in the country. The region's PNMR stands at 39 per 1000 births, higher than the national

average. The Greater Accra Region has the fourth highest PNMR in the country (Ghana Statistical Service, 2015).

The known risk factors for stillbirth are obstetric complications, hypertensive disorders in pregnancy, infections, placental dysfunction and congenital defects. The main causal pathway proposed for stillbirths is impaired placental function. The risk factors for neonatal mortality are prematurity related complications, intra-partum related complications and infections. The risk factors for stillbirth and neonatal deaths are invariably similar. A large proportion of perinatal deaths seem to originate from maternal complications during pregnancy (Khanam et al., 2017). According to the World Health Organization, PNM are largely due to obstetric causes (World Health Organization, 2006).

Maternal health is inseparably linked with perinatal health: the major risk factors for morbidity and mortality among both are similar. When women develop complications in pregnancy, their infants are at greater risk of becoming disabled or dying (Yirgu et al., 2016). Maternal complications contribute to high rates of perinatal mortality (Khanam et al., 2017). In a three-year study carried out to determine the pattern of obstetric emergencies and its influence on maternal and perinatal outcome at the Olabisi Onabanjo University Teaching Hospital in Nigeria, although obstetric emergencies accounted for 18.5% of the 1420 total deliveries, they were responsible for 86% of the perinatal mortalities recorded over the period (Mustafa Adelaja & Olufemi Taiwo, 2011). A retrospective observational study of obstetric emergencies admitted at a tertiary facility over a two-year period in Western India showed that, PNM among obstetric emergencies (148 per 1000 births) was significantly higher than the overall PNM of the facility (110 per 100 births) ($p < 0.05$). Also, incidence of low birth weight (LBW), prematurity and birth asphyxia, which are major causes of PNM, was significantly higher among obstetric emergency cases ($p < 0.05$) (Bangal, Borawake, & Chandaliya, 2012).

Antepartum complications contribute to high rates of perinatal mortalities. A study conducted in rural Bangladesh in which data on self-reported antepartum complications during the last pregnancy and corresponding pregnancy outcomes were obtained from a household survey of 6,285 women to determine the risk of perinatal mortality associated with antepartum complications, 356 perinatal deaths were identified. The highest risk of perinatal mortality was associated with antepartum haemorrhage (IRR = 3.5, 95% CI: 2.4–4.9 for perinatal deaths), Pregnancy-Induced hypertension was significantly associated with stillbirths (IRR = 1.8, 95% CI 1.3–2.5) and Probable Infection was a significant risk factor for early neonatal deaths (IRR = 1.5, 95% CI 1.1–2.2) (Khanam et al., 2017). A cross-sectional study conducted in Kenya among 910 births conducted between January 1996 and July 1997 to identify and quantify risk factors for perinatal mortality in a Kenyan district hospital showed that complications associated with labour such as haemorrhage, premature rupture of membranes/premature labour, and obstructed labour/malpresentation increased the risk of PNM between 8- and 62-fold. Also, 53% of all PNMs were attributable to labour complications (Weiner et al., 2003). Care by a skilled birth attendant and timely access to comprehensive emergency obstetric care (cEmOC) are required to prevent and manage these complications. This makes referral systems critical for the survival of these women and their babies (Afari, 2015).

Fifteen percent of pregnant women will develop complications in pregnancy or during childbirth (Afari, 2015). Pregnancy and childbirth related complications are unpredictable, and can progress rapidly to become severe and life threatening. For instance, a major haemorrhage could lead to the death of the mother or fetus within minutes or hours without timely intervention (Fournier, Dumont, Tourigny, Dunkley, & Dramé, 2009). Although most obstetric complications cannot be predicted, most can be treated with timely provision of a package of evidence-based interventions termed Emergency Obstetric Care (EmOC) (Rohit & Nitin,

2016). It is estimated that EmOC could contribute up to 10–15% reduction in all-cause neonatal mortality, and 20–60% reduction in mortality due to birth asphyxia (Darmstadt et al., 2005).

Emergency obstetric care (EmOC) refers to elements of obstetric care required in the management of complications that occur during pregnancy, delivery and postpartum period, skilled personnel, equipment as well as support services (Rohit, Nitin & Vasantrao, 2016). They are key medical interventions used in treating the direct obstetric complications that cause most maternal deaths worldwide. Signal functions are used as indicators to determine the level of care being provided by a facility (WHO, UNFPA, & UNICEF, 2009). Basic EmOC services/facilities provide seven signal functions, namely: administration of parenteral antibiotics, administration of uterotonic drugs (i.e. parenteral oxytocin), administration of parenteral anticonvulsants for preeclampsia and eclampsia (i.e. magnesium sulphate), manual removal of placenta, removal of retained products (e.g. manual vacuum extraction, dilation and curettage), performing assisted vaginal delivery (e.g. vacuum extraction, forceps delivery) and undertaking of basic neonatal resuscitation (e.g. with bag and mask). A comprehensive EmOC facility will run all the seven signal functions mentioned above, plus two additional ones, namely performing surgery (e.g. caesarean section) and undertaking blood transfusion (WHO et al., 2009).

Shortell and Anderson, 1971 defined referral as “a permanent or temporary transfer (including sharing) of responsibility for a patient's care from one physician to another” (Adam, 2015, p.8). Referrals are an integral part of any healthcare system, and remain a key aspect of emergency obstetric care. Obstetric referrals are associated with high perinatal mortality. A cross-sectional study of stillbirths in Rural Hospitals in the Gambia showed referral from a peripheral health facility were highly significantly associated with higher stillbirth rates 3.82 (95% CI 2.24–6.51) (Jammeh, Vangen, & Sundby, 2010). According to Afari (2015), a significant component of

maternal and perinatal deaths in the developing world can be attributed to referral systems that are confronted with multiple barriers (Afari, 2015).

Deficiencies and weaknesses of health systems, particularly with regard to referral linkages affect access to EmOC, and eventually influence maternal and fetal outcomes negatively (Njoroge, 2011). Most pregnancy-related complications cannot be managed at the primary care level and would require referral to the next level of care (Murray & Pearson, 2006). This makes effective, appropriate and timely referrals of obstetric emergencies important (Jammeh, Sundby, & Vangen, 2011). Delays associated with referral systems are critical in determining maternal and foetal outcomes of pregnancy (Jammeh et al., 2011).

Delays in accessing EmOC in an obstetric emergency can be examined using the Thaddeus and Maine's three delay model. According to the model, delays occur at the following three levels:

- Delay in seeking obstetric care: common obstacles here include financial barriers, transport difficulties and distance. Social factors include lack of ability to understand weightiness of the complication, the need to seek permission from spouse or family decision makers among others.
- Delay in reaching an appropriate health facility which has a functioning obstetric unit after decision: factors here include communication and transport difficulties.
- Delay in receiving appropriate care on arrival at the health facility: factors causing such delay include poor staffing, staff insensitivity, poor organization setups, lack of resources among others (Njoroge, 2011).

Minimising the causes of these delays can reduce maternal morbidity and mortality, as well as reduce perinatal morbidity and mortality (Lee, Lawn, Cousens, Kumar, & Osrin, 2012). The first, second, and third delays were shown to have contributed to 19%, 21%, and 73% of

perinatal deaths respectively in an audit of perinatal deaths in a hospital in Tanzania (Mbaruku, van Roosmalen, Kimondo, Bilango, & Bergström, 2009).

Despite the critical role of maternity referral systems on maternal and perinatal health, maternity referral systems in developing countries are far from optimal (Murray & Pearson, 2006). Maternity referral systems have been under-documented, under-researched, and under-theorized. A functional referral system, ensuring continuum of care between home and the health facility(ies), is necessary if the potentially deadly delays are to be minimized. Much of the literature on effective care at birth have focused on content of care or the caregiver, but few provide evidence for linkages between home and hospital, and between levels within the healthcare system (Lee et al., 2012). Also, knowledge on how maternity referral systems affect neonatal health and survival in developing countries is lacking (Murray & Pearson, 2006).

This study therefore seeks to determine the relationship between referral system gaps and access to EmOC, and to determine factors associated with adverse perinatal outcomes among women referred with obstetric emergencies. Understanding these associations is critical in guiding development of strategies and programs to deliver maternal interventions of proven efficacy.

1.2 Problem statement

Seven million perinatal deaths occur annually in the world. Almost all of these deaths occur in developing countries. PMR in developed countries range from 6 to 10 per 1000 births, while in developing countries, it ranges between 40 to 60 per 1000 births (Yirgu et al., 2016). The Africa region has the highest PNMR in the world (62 per 1000 births), and within Africa, West Africa has the highest PNMR (76 per 1000 births). Under five mortality rates have decreased substantially over the past 20 years in developing countries. However, PNM has not followed

a similar pattern. PNM remains a public health problem (Khanam et al., 2017). Likewise, the PNMR in Ghana has not changed over the past six years. The PNMR in 2008 according to the Ghana Demographic and Health Survey was 39 per 1000 births, and 38 per 1000 births in 2014 (Ghana Statistical Service, 2015). This is despite the creation and implementation of the Child Health Policy 2007-2015 interventions.

The interventions include those implemented during pregnancy (e.g. Prenatal nutrition including iron and foliate supplementation; at least 2 doses of intermittent preventive treatment for malaria etc.), those implemented for delivery and the immediate post-delivery period are (e.g. Monitoring progress of labour, maternal and foetal well-being with partograph etc.), interventions during the neonatal period (e.g. exclusive breastfeeding; thermal care etc.), intervention to infants and children (e.g. exclusive BF to 6 months, Insecticide Treated Nets etc.) among others (Ghana Health Service, 2015). Other interventions include the development of the referral policy and guidelines, provision of free maternal healthcare services among others (Afari, 2015).

There is therefore the need to relook at factors associated with the unacceptably high PNMR, in order to help guide intervention efforts. Many PNMs originate from maternal complications (Khanam et al., 2017). Perinatal mortality is higher among obstetric emergency cases (Bangal et al., 2012) and among referred obstetric clients (Jammeh et al., 2010). Due to referral system challenges such as lack of appropriate transport, long distance of travel, financial constraints among others, maternal and foetal conditions are already compromised on arrival at the receiving facility. Treatment at receiving health facilities therefore prevents only major mishaps such as maternal death but fails to bring about any major impact on perinatal outcome (Narwadkar, Mangesh Vinayak, Sakhare Anil Panditrao, 2004).

Without a relook at the factors associated with PNM among referred obstetric emergencies, with focus on both medical, social and health system factors, Ghana risks not meeting the Sustainable Development Goals (SDGs) target on child health. Also, the negative economic, psychological and social consequences of PNM on the mother, the family and the country will persist. Mothers who experience PNM show increased incidence of depressive symptoms, guilt, prolonged grieving, and feelings of loss of control. Some experience prolonged grief reactions and marital disharmony that lead to separation and divorce. Negative social consequences include isolation from friends, extended family members among others (Gausia et al., 2011).

1.3 Justification

Many studies have examined the determinants of perinatal mortality among the generality of pregnant women, however, few have studied factors associated with PNM among women referred with obstetric emergencies. Perinatal mortality among women with obstetric emergencies/complications have been described in high income countries and a few low resource settings such as Nigeria, Kenya, Bangladesh and India (Vogel et al., 2014; Kusiako, Ronsmans, & Van Der Paal, 2000) . Findings from the studies above can however not be extrapolated to Ghana, which has peculiar challenges. To our knowledge, no such study has been conducted in Ghana. This study will provide information on the prevalence of PNM among women referred due to obstetric emergencies, as well as the factors associated with PNM among the referred clients. The provision of context-specific challenges by this study will help in planning and implementation of context-specific and appropriate interventions.

Most literature focus on content of care or on the caregiver and not on the linkages between home and hospital, and between hospitals (Lee et al., 2012). This study also sought to find the relationship between timely and appropriate referrals and the occurrence of perinatal mortality

among obstetric emergencies. It will quantify the role of maternal referral systems in determining perinatal outcomes. This will bridge the knowledge gap with regards to how maternity referral systems affect perinatal survival (Murray & Pearson, 2006).

In the short to medium term, this study will guide interventions which will ultimately aid Ghana to achieve the Sustainable Development Goal Three, targets two and seven which deal with ending preventable deaths of newborns and under-five children and ensuring universal access to sexual and reproductive health care services respectively.



1.4 Conceptual framework

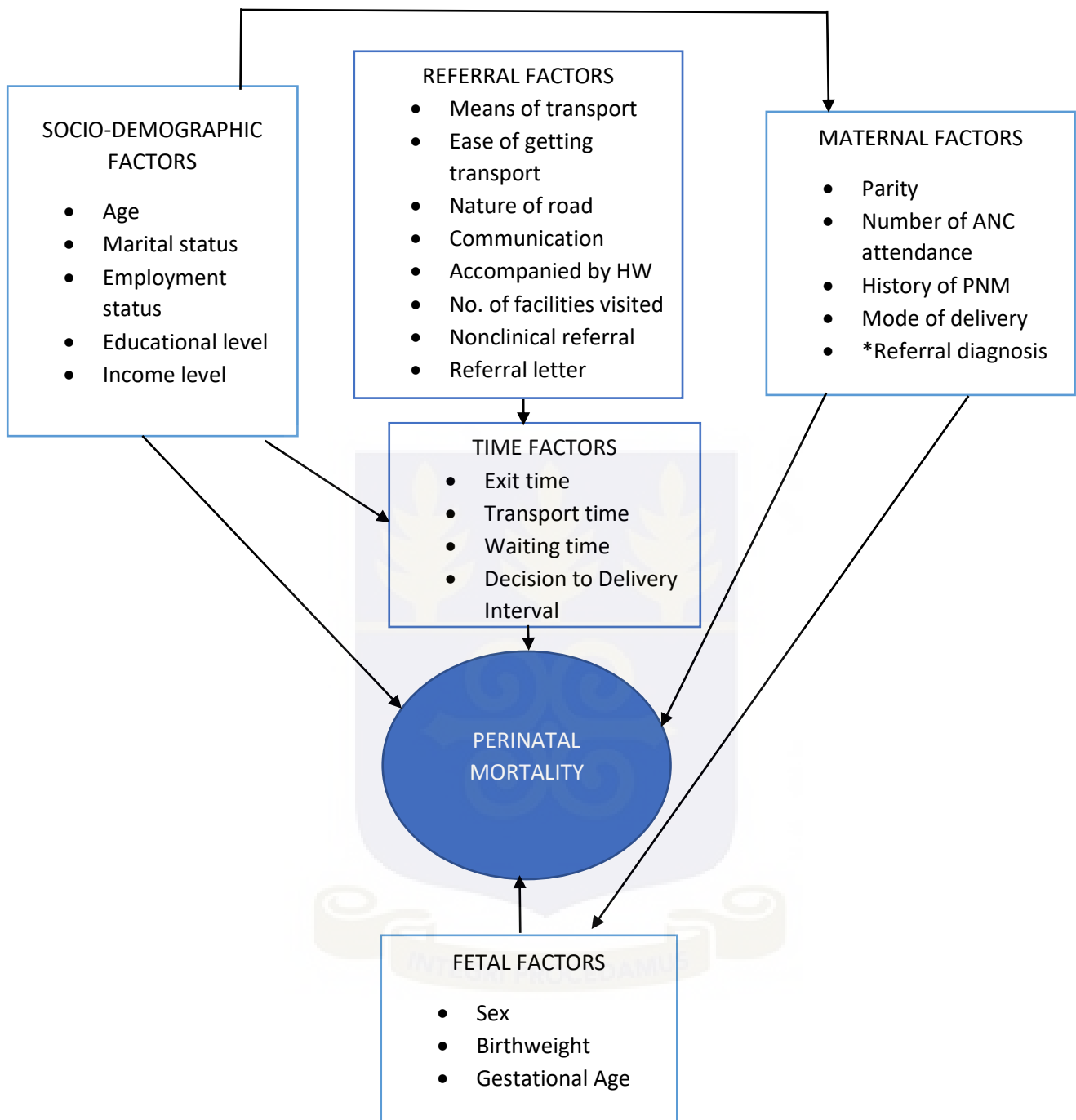


Figure 1: Conceptual framework showing factors associated with Perinatal Mortality among referred obstetric emergencies

Source: Authors construct, 2017

1.4.1 Conceptual framework narration

Studies have found out that certain factors have a direct or indirect relationship with PNM among women referred on account of obstetric emergencies. This framework (figure 1.1) seeks to explain the various variables that have a direct or indirect relationship with PNM. The variable of interest as derived from literature include referral system factors (such as means of transport, ease of obtaining transport among others), time factors such as exit time, travel time etc., socio-demographic, maternal and foetal factors.

Improved communication and transport systems have been recognized to improve access to EmOC through reduction in delays to receiving care (Lee et al., 2012). Communication between referring facility and cEmOC facility may reduce time to conduct a caesarean section (Fournier et al., 2009). Mode of transport, ease of obtaining transportation are factors identified to cause delays in accessing care (Afari, 2015). Women with obstetric emergencies could be referred on account of non-clinical factors such as absence of a doctor, lack of supplies among others. Such referrals could affect time to receiving care. Non-compliance (by going home first before proceeding to referral hospital) to referral advice can vary times to which women with obstetric emergencies arrive at the receiving health facility (Nwameme, Phillips, & Adongo, 2014). Referrals with accompanying referral letters can affect time to receiving care at the receiving facility. In general, referral system gaps are a contributory cause of perinatal mortality (Jebet & Oyore, 2015). Referral status is a risk factor for perinatal mortality (Brahmanandan et al., 2017).

Studies have shown that time to reaching and receiving care is a measure of access to EmOC (Myers, Fisher, Nelson, & Belton, 2015). Time to receiving care is important in determining foetal outcome in obstetric emergencies. In an Indian study, perinatal mortality among referred obstetric emergencies was directly proportional to the time taken by a clinician to refer, and

the time taken to reach the hospital (Patel, Singh, Patel, & Sharma, 2012). Delays in accessing EmOC have adverse effect on foetal outcome (Mbaruku et al., 2009).

Studies have also revealed that Parity, number of ANC attendance, referral diagnosis, history of PNM and mode of delivery are maternal factors directly associated with PNM (Tachiweyika et al., 2011). For instance, a nested case-control study conducted in Ethiopia found primiparas to have greater odds of perinatal mortality compared to grand multiparous women (Yirgu et al., 2016).

Also, foetal factors such as sex, birth weight and gestational age have been directly associated with PNM. A case in point: birth weight less than 2.5kg was identified to increase the risk of PNM compared with normal birth weight of 2.5-4.0kg (Bayou & Berhan, 2009).

Socio-demographic factors have also been identified from studies to be directly associated with PNM. For example, low maternal educational level and unemployment were shown to be associated with an increased risk of PNM (Tachiweyika et al., 2011).

Maternal factors have also been directly associated with foetal factors. Birthweights have been shown to increase in subsequent pregnancies (Boghossian & Laughon, 2015). Nulliparous women have higher odds of prematurity and small for gestational age compared to women who were parity 1-2 (Kozuki et al., 2013).

A direct relationship has been shown to exist between socio-demographic factors and maternal factors. For instance, higher education level has been associated with optimum ANC attendance (Cooper, Regan, & Muyunda, 2016).

In conclusion, it is notable that there are multifaceted factors that have a direct or indirect relationship with PNM. Understanding the pathways will help in addressing the challenge of

high perinatal mortality rates in developing countries in general, and in the Accra and Tema Metropolis in particular.

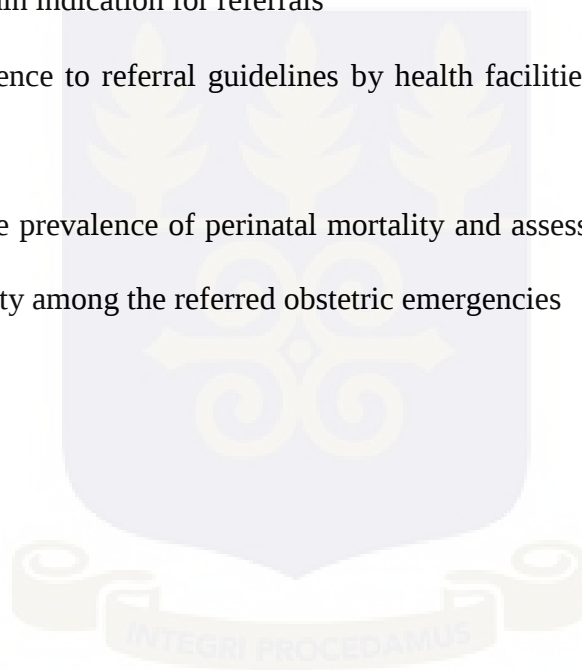
1.5 Objectives

1.5.1 General objective

To assess the prevalence and factors associated with perinatal mortality among referred obstetric emergencies in the Accra and Tema Metropolis.

1.5.2 Specific objectives

- To assess the main indication for referrals
- To assess adherence to referral guidelines by health facilities (HFs)/ health workers (HWs)
- To determine the prevalence of perinatal mortality and assess factors associated with perinatal mortality among the referred obstetric emergencies



CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews literature on the subject on the global, regional, national and subnational levels.

2.1 Concept of referral

A referral is defined as “a process in which a health worker at a one level of the health system, having insufficient resources (drugs, equipment, skills) to manage a clinical condition, seeks the assistance of a better or differently resourced facility at the same or higher level to assist in, or take over the management of, the client’s case” (Adam, 2015).

Referral ‘involves transfer of all or some of the responsibility for patient care temporarily or permanently for a particular purpose such as investigation, consultation, care or treatment of the patient’. It involves co-operation, coordination and information transfer between the various levels of service delivery (Ministry of Health, 2012).

Referrals are requested under two main circumstances, either routine or as an emergency (Adam, 2015). Types of referrals include internal, external or international referrals. A referral system basically includes 3 major interrelated and integrated components. These are the referring physician, the patient and the specialist referred to (Ministry of Health, 2012).

The main reasons for referring a patient include:

- To seek expert opinion regarding the patient
- To seek additional or different services for the patient
- To seek admission and management of the patient
- To seek use of diagnostic and therapeutic tools (Adam, 2015)

2.1.1 Health system/ referral structure

Since the emergence of primary healthcare, referral systems have become an important component of healthcare systems, particularly in developing countries (Murray & Pearson, 2006).

The health service in Ghana is comprehensive and organised in a hierarchical order. Service delivery follows the three-tier system of care; primary, secondary and tertiary level services. The primary healthcare services are offered at the community and the sub-district level. Secondary care is offered at the district and regional hospitals while tertiary care, including specialized care, is offered at the teaching hospitals. The teaching hospitals also serve as research and medical training centres. Other key contributors to the healthcare delivery system in Ghana include the Christian Health Association of Ghana (CHAG), private healthcare providers (for profit) as well as the traditional practitioners (Adjei, 2015).

2.1.2 Effective maternity referral systems

In a scoping review of literature on obstetric referrals in developing countries, the following were identified as likely requisites for a successful maternity referral system: a referral strategy informed by the assessment of population needs and health system capabilities; an adequately resourced referral center; active collaboration between referral levels and across sectors; formalized communication and transport arrangements; agreed setting-specific protocols for referrer and receiver; supervision and accountability for providers' performance; affordable service costs; the capacity to monitor effectiveness; and underpinning all of these, policy support” (Murray & Pearson, 2006).

An effective referral system provides many benefits. It minimizes cost of treatment, as well as cost of illness prevention. It ensures continuum of care and provides an important opportunity for mutual understanding, upgrading knowledge and effective learning of all those involved (Adam, 2015). Additionally, maternity referral may be considered a useful ‘tracer’ for analysis

of healthcare systems. Communication and transport initiatives initiated in maternity care have tended to also be utilized for other health emergencies (Murray & Pearson, 2006).

2.1.3 Ghana referral policy and guidelines

Ghana's referral policy and guideline document was developed in May, 2012, in recognition of the critical role of referrals in healthcare delivery and to address the delays in accessing critical and emergency care when patients are referred. The document adopts standard procedures that define roles and responsibilities of referring and receiving health facilities.

Few recommendations by the guideline/ policy document relevant to this study include the following:

1. On the referral process, it states that a completed standard referral form must accompany any patient being referred.
2. On communication of patient care: it states that where possible, referrals must have prior communication (e.g. telephone, radiophone, email, fax etc.) with the receiving facility.
3. On emergency services, it states that:
 - Emergency services must be provided at all times, including weekends and holidays
 - The emergency team on duty must officially and immediately receive emergency referrals / cases to the facility to be urgently evaluated
4. On transportation, the document states that patients may be conveyed to and from the health facilities using a suitably equipped ambulance or whatever other appropriate means of transport available.

5. Where an ambulance is used, the referring facility should make adequate provision for the return of the nurse/ practitioner to the facility.
6. Feedback should be sent to the referring facility by the receiving facility.
7. Referrals from all health institutions, including private health facilities must conform to the Ministry of Health referral policy and guideline document (Ministry of Health, 2012).

2.2 Referral system challenges

The Sustainable Emergency Referral Care (SERC) initiative, an emergency referral pilot, was launched by the Ghana Health Service in some districts in the Upper East Region of Ghana in 2012. The SERC initiative was part of a six-year health systems improvement project known as the Ghana Essential Health Intervention Program. SERC was a low-cost emergency transportation and communication system plus community education activities aimed at addressing common access, organizational and knowledge barriers to emergency care services. It used three-wheeled motorcycles known as “motorking” with modifications as ambulances. Dual-SIM mobile phones were distributed to health facilities, health workers, volunteer drivers as well as community health officers. As part of appraisal of the system, health workers were surveyed in order to identify challenges to effective emergency referral services. Challenges identified included poor road conditions (95%), which was the most common challenge reported. Also, lack of driver motivation (59%), cultural practices and lack of knowledge that delay seeking care (40%), poor communications networks (32%); and adverse weather conditions (29%). The following were less reported: inability to take time away from work or family obligations (20%); the cost or unavailability of fuel (19%); poor communication between health facilities (18%); lack of readily available transport options (13%); or lack of ‘motorking’ acceptability (12%) (Patel et al., 2016).

Number of facilities visited prior to admission at referral centre: Referred obstetric emergencies may visit one or more hospitals before arrival at a facility at which they will be admitted for definitive care. One hundred and twelve referred obstetric emergencies (93.3%) admitted at tertiary hospital in Bangalore, India over a two-year period were noted not to have been to any prior facility (they were first referrals). However, 8 patients (6.67%) were second referrals (had been to one facility prior to arrival at the tertiary facility). Reasons however for second referral were not stated in this study (Patel et al., 2012).

Protocol non-adherence: survey of health workers on protocol adherence as part of appraisal of the SERC initiative in the Upper East Region of Ghana, protocol non-adherence was identified for some aspects of care. Although the protocol required that referred clients be accompanied by a health worker, many referred patients were unaccompanied (67%). Interviews of the health workers identified the following reasons for not accompanying the referred patients: Thought patient was accompanied by another health worker (37%); health worker was the only staff at the facility and so could not leave post (35%); did not feel comfortable riding in the ambulance (16%); and patient will not benefit from being accompanied by the health worker (4%) (Patel et al., 2016)..

Receiving facilities also failed/ ignored to provide patient outcome feedback to the referring facility although the protocol required it (Patel et al., 2016). In a study in Ghana aimed at describing the referral process of expectant mothers to the Greater Accra Regional Hospital, Ridge, Accra, from the Shai-Osudoku district hospital also in Accra, the referring facilities did not receive feedback on most of the referred expectant mothers (65.2%), and for those that feedback was received (34.8%), feedback was via verbal communication (Adam, 2015).

Also, referring facilities often failed to call in advance to alert the receiving facilities of an incoming patient (Patel et al., 2016). Adam (2015) in a study on the referral processes and

services for expectant mothers and new-borns at the Shai-Osudoku District Hospital in Accra, Ghana, found out that although most (81.7%) of the referrals were regarded as emergencies, there was no inter-facility communication between the referring and receiving health facilities for most of the referrals (66.1%).

2.3 Referrals, communication and transport systems, access to cEmOC and perinatal mortality

In obstetric emergency, timely access to EmOC is vital for the survival of both mother and baby. In a study of obstetric emergencies referred to a tertiary facility in India over a two-year period, results showed that, maternal morbidity was directly proportional to the time taken by the clinician to refer, travel distance and time taken to arrive at the hospital. Similarly, both Perinatal morbidity and mortality were directly proportionate to the time taken by clinician to refer and the time to arrive at the hospital (travel time) (Patel et al., 2012).

Communication and transport systems are a pre-requisite for an effective referral system. Improved communication and transport systems have been identified to improve access to emergency care, including emergency obstetric care. A reduction in delay in recognizing the need for referral and arranging transport in a timely manner to a first level facility may be achieved by improving communication between home birth attendant and a trained staff via two-way radio or via mobile phone (Lee et al., 2012). Communication between referring facility and cEmOC facility may reduce delays in the conduct of a caesarean section (Fournier et al., 2009)

In the SERC initiative in the Upper East Region of Ghana which involved provision of tricycle ambulances, cell phones to health care workers/ facilities and community engagements, monitoring data showed that community exposure to SERC was associated with an increased volume of emergency referrals (Patel et al., 2016).

In the Balochistan Safe Motherhood initiative, Pakistan, where TBA's were trained in recognizing, stabilizing and referring obstetric emergencies, and given wireless telecom systems to call and organize an ambulance. Perinatal mortality rates and neonatal mortality rates were found to be lower in the intervention areas compared to the control areas (perinatal mortality rate was 49.4 per 1000 compared with 85.2 per 1000 in the comparison areas, neonatal mortality was 32.4 per 1000 compared with 48 per 1000 in the comparison area) (Midhet & Towghi, 1998).

The Rural Extended Services and Care for Ultimate Emergency Relief (RESCUER) program in Sierra Leone, which involved enhancement of communication systems plus emergency transport using four-wheeled ambulances, the number of women received at Bo Government Hospital from the project area increased from 0.9 to 2.6 per month, case fatality rate dropped from 20% to 10% (Lee et al., 2012).

A maternity referral system established in Mali comprising radio communications between health facilities, ambulance service and community cost sharing schemes, a two year post implementation evaluation in Kayes showed increased institutional deliveries (from 19% to 39%), while proportion of obstetric emergencies treated increased from 0.9% to 1.9% of births (Fournier et al., 2009).

Some studies however found no reduction in transport time despite the employment of alternative and innovative transport means. In Malawi, bicycle ambulances were found not to reduce transport time (Lungu, Kamfose, Chilwa, & Hussein, 2000).

The RESCUER project in Uganda, where TBAs attending to home visits were equipped with solar-powered radio communication devices. This intervention reduced the referral time from the most peripheral centers by 2 hours. In Sierra Leone, radio communications to help dispatch

ambulances to health centers resulted in increased monthly admissions, increased referrals as well as increment in referrals within one hour of decision making (Lee et al., 2012).

2.4 Obstetric emergency referrals

2.4.1 Clinical reasons for referrals

In a Kenyan study to determine outcome of pregnancy among obstetric emergency referrals to the Kenyatta National Hospital, the medical/ obstetric complications for which the pregnant women were referred included antepartum and postpartum haemorrhage, severe preeclampsia/eclampsia, malpresentations not compatible with vaginal delivery, twin gestation with preterm premature rupture of membranes and acute renal failure (for dialysis) secondary to poorly managed hypertension in pregnancy. Diagnosis made on arrival at the receiving hospital (Kenyatta National Hospital) were as follows: normal labour (18.9%), antepartum haemorrhage (13.2%), non-reassuring foetal status (12.3%), pre-eclampsia (11.4%), eclampsia (8.3%), malpresentation (7.6%), cephalo-pelvic disproportion (CPD) in labour (6.6%), postpartum haemorrhage (PPH) (5.7%), obstructed labour (3.9%) among others (Njoroge, 2011).

In a retrospective study of obstetric emergencies admitted to a tertiary health facility in Western India over a period of two years, obstetric emergencies occurred more over the antenatal period (52.0%) than the intrapartum (32.0%) or the postnatal period (16.0%). Commonest antepartum complications were haemorrhage and severe hypertension. The common intrapartum complications included prolonged labour, obstructed labour and ruptured uterus. Common emergencies during the postpartum period included postpartum haemorrhage (PPH), retained placenta, inversion of uterus and puerperal sepsis (Bangal et al., 2012).

In a two-year prospective study of 120 obstetric emergencies between 28 weeks of gestation to 6 weeks postpartum referred to the Sri Bhagwan Mahaveer Jain Hospital, Bangalore, India, most (84) were antepartum emergencies, 12 were intrapartum and 24 were postpartum

emergencies. Most of the referrals were due to hypertensive disorders (50%), 11.6% had placenta abruptio, 13.32% had Postpartum haemorrhage (PPH), 8.33% were referred on account of placenta previa, 8.33% for deep transverse arrest, 1.66% for compound presentation among others (Patel et al., 2012).

Among the 1468 systematically sampled pregnant women of gestational age equal or more than 28 weeks referred to a tertiary care facility in Maharashtra, India, Preeclampsia & related conditions were the major indication of referral (22.27%) of the cases. Anaemia constituted 18.05%, malpresentation 15.19%, preterm premature rupture of membranes (PPROM) 6.2%, antepartum haemorrhage (APH) 6.13%, foetal distress 5.24%, preterm labour 3.8%, Cephalopelvic disproportion (CPD) 3.7% among others (Rohit et al., 2016).

In Western Nigeria, the most common indications for obstetric emergency referrals to the Olabisi Onabanjo University Teaching Hospital (were prolonged/ obstructed labour, postpartum haemorrhage, foetal distress, severe pregnancy-induced hypertension/ eclampsia and antepartum haemorrhage (Adelaja & Taiwo, 2011).

2.4.2 Non-clinical reasons for referrals

Reasons for referrals to the Kenyatta National Hospital, Nairobi, included clinical and non-clinical reasons. The main non-clinical reason for referral of women with obstetric emergencies was lack of theatre (34.2%). Other reasons included lack of supplies (25.9%), medical/ obstetric complications (23.7%), financial constraints (8.3%), lack of a doctor (2.6%), lack of anaesthetist (2.2%) among others (fear of complications, patient and relative request etc.) (3.1%) (Njoroge, 2011).

2.5 Perinatal mortality among referred obstetric emergencies

PNM is high among obstetric emergencies and among referred clients. A two-year observational study of obstetric emergencies admitted to Pravara Rural hospital, a tertiary care

hospital attached to Rural Medical College located in rural area of Ahmednagar district in Maharashtra, Western India, PNMR among obstetric emergencies reporting to the facility was 148 per 1000 births. This was significantly higher than the hospital's overall PNMR of 110 per 1000 births ($p < 0.05$) (Bangal et al., 2012).

The PNMR among women with obstetric emergencies referred to the Kenyatta National Hospital in Nairobi, Kenya was 0.53 per 1000 births. PNM was defined as death of foetus at or after 28 weeks of intrauterine life and within first seven days of extrauterine life (Njoroge, 2011)

The PNMR among women with obstetric emergencies referred to the Sri Bhagwan Mahaveer Jain Hospital, a tertiary health facility in Bangalore, India, was 187 per 1000 births. In this study, perinatal mortality included both late foetal deaths (i.e. intra-uterine deaths after 28 weeks gestation and still births) and early neonatal deaths (Patel et al., 2012).

In a prospective study of 1468 pregnant women 28 weeks gestation and beyond (excluding postpartum referrals) to assess the timeliness and appropriateness of referral, as well as the foetal and maternal outcome, results showed a 10.01% of the babies were still born, while another 4.08% died in the neonatal period. The time or day of death within the neonatal period was however not specified (Rohit et al. , 2016).

2.6 Factors associated with perinatal mortality

2.6.1 Socio-demographic factors

Age: In a case control study to determine risk factors for perinatal mortality in Alexandria, Egypt, very young (<20 years) and very old mothers (>35 years) had a higher risk of PNM compared to middle-aged mothers (OR=4.1; 95% CI: 1.7–10.1 and OR=6.7; 95% CI: 2.9–14.9, respectively) (Hassan, Ahmed, Shehata, & Sadek, 2012). Similarly, a retrospective cohort study in Scotland showed women aged 40 and above had a two-fold risk of delivery related

PNM compared to women aged 25-34 (King, 2011). However, in an unmatched case-control study conducted in Mashonaland East Province, Zimbabwe, there was no significant association between maternal age and PNM (Tachiweyika et al., 2011). Also, in a community-based prospective cohort study in Uganda, age less than 20 (Adjusted RR= 0.8; 95%CI : 0.2, 3.2), and those aged above 30 (Adjusted RR= 2.0; 95%CI: 0.7-6.0) had no difference in terms of risk of PNM compared to those aged 20-30 years (Nankunda, 2011). A WHO maternal and perinatal health survey conducted in Nigeria found maternal age to be significantly associated with PNM ($p<0.0003$). PNM was more prevalent among those age 35 years and above, while those age 21-25 years had the least proportion of PNMs (Umezulike, 2011).

Marital status: In a community-based prospective cohort study in Eastern Uganda, there was no difference in risk of PNM among the married women compared to the unmarried women (Unadjusted RR= 1.0, 95% CI:0.4- 2.6) (Nankunda, 2011). However, a population-based study in Murmansk County in Russia found marital status to be significantly associated with PNM ($p<0.001$). Singles had higher odds of PNM compared to married women (COR=1.84; 95% CI,1.35–2.52) (Usynina et al., 2017).

Employment status: In a case-control study conducted in Marondera District, Zimbabwe, unemployed mothers were found to have a higher risk of PNM compared to those with employment (OR=2.17, CI (1.24 – 3.75)) (Tachiweyika et al., 2011).

A nested case-control study in West Gojam, Ethiopia, found no significant association between maternal occupation (housewife/ farmer) and PNM. It noted that farmers had no increased risk of PNM compared to housewives (COR=1.09; 95%CI= 0.66, 1.83) (Yirgu et al., 2016).

Educational level: In Zimbabwe, a case control study showed having primary or no maternal education increased the risk of PNM compared to having higher levels of education [OR=5.50 (3.14-9.33)] (Tachiweyika et al., 2011). Similarly, a WHO maternal and perinatal survey

conducted in Nigeria found maternal duration of schooling to be significantly associated with PNM ($p < 0.0001$). The prevalence of PNM was highest among those with zero years of education (13.7%), and those with up to 6 years of education (8.0%) compared to those with 7-12 years, 13-18 years and above 18 years of education (6.4%, 5.1% and 4.4%). Prevalence of PNM reduced with increasing years of maternal schooling (Umezulike, 2011).

Nonetheless, a nested case control study in West Gojam, Ethiopia, found no increase in risk of PNM with respect to educational level. Mothers with primary and above education had not reduced risk of PNM compared to the illiterate mothers (COR=0.59; 95% CI= 0.16, 2.19)(Yirgu et al., 2016). Also, a case control study on risk factors for PNM in Kerala, India, found no increase in risk or odds of PNM with respect to educational level of the mother (Brahmanandan et al., 2017)

Income level: With regards to wealth level or income status, new-borns from families in the second quintile of the wealth index had reduced odds of perinatal mortality (AOR = 0.38, 95% CI 0.16–0.93) compared to new-borns from households in the lowest quintile (Yirgu et al., 2016). In a case control study in Alexandria, Egypt, those of a low social status had a higher risk of PNM, 1.5 times compared to those of middle social status (OR=1.5; 95% CI: 0.95–2.37) (Hassan et al., 2012). Income level is considered as a proxy to socio-economic status.

2.6.2 Maternal factors

Parity: In a prospective cohort study conducted from 2006 to 2008 in Eastern Uganda involving 835 pregnant women followed up till 7 days post-delivery, multivariable generalized linear model regression analysis showed that risk of perinatal mortality was higher among nulliparous women (ARR, 3.3; 95% CI;1.5- 7.0), compared to those with one or more children (Nankunda, 2011). A nested case-control study conducted in Ethiopia also found primiparous

women to have greater odds of perinatal mortality compared to grand multiparous women (AOR, 3.15; 95% CI, 1.03–9.60) (Yirgu et al., 2016).

However, grand multiparous women had a significantly higher risk of perinatal or neonatal mortality in a case-control study conducted in Alexandria, Egypt (OR=3.40; 95% CI: 1.7–7.1) (Hassan et al., 2012). A case-control study in Zimbabwe also found risk of PNM to be higher among grand multiparous women (OR=4.80, CI (1.62 – 14.23)) (Tachiweyika et al., 2011).

In a WHO maternal and perinatal health survey conducted in Nigeria, parity was significantly associated with PNM ($p=0.0003$). Higher proportions of perinatal deaths were recorded among nulliparous and grand multiparous women compared to primipara and multiparous women (Umezulike, 2011).

In a community-based prospective cohort study in Eastern Uganda, there was no difference in terms of risk of PNM between nulliparous women and those with one and more children (Unadjusted RR=1.2; 95% CI: 0.4- 3.3) (Nankunda, 2011).

Number of ANC visits: Antenatal visits of less than four during index pregnancy was significantly associated with perinatal and neonatal mortality upon logistic regression analysis of a case control study done in Alexandria, Egypt (Hassan et al., 2012).

However, there was no difference with regards to risk of PNM between those who attended, and those who did not attend ANC (Unadjusted RR=1.3, 95% CI: 0.5- 3.4) in a prospective cohort study in Eastern Uganda (Nankunda, 2011).

History of PNM: A case-control study in Alexandria, Egypt, found that, women with past history of PNM or neonatal mortality were significantly at increased risk of PNM/ neonatal mortality (OR=9.5, 95% CI: 5.3–17.2) (Hassan et al., 2012). A nested case-control study in Gojam, Ethiopia, also found women with history of PNM in their last pregnancy to have higher odds of PNM compared to those without history of PNM (AOR = 9.55, 95% CI 4.67–19.54)

(Yirgu et al., 2016). Similarly, another case-control study in Marondera District, Zimbabwe, found mothers with history of stillbirth (OR=4.34, CI (2.26 – 8.37)) and those with history of early neonatal death to be at increased risk of PNM (OR=7.22, CI (2.98 – 20.77)) (Tachiweyika et al., 2011).

Mode of delivery: In a case control study at the Hawassa University Hospital, Ethiopia, delivery by Caesarean section had reduced odds (AOR, 0.4; 95% CI; 0.25-0.59) of perinatal mortality compared to delivery by spontaneous vaginal delivery. In another case-control study in Ethiopia however, no significant association between instrumental delivery and perinatal mortality (AOR, 0.6; 95% CI; 0.28-1.42) was observed (Bayou & Berhan, 2009). A nested case-control study conducted in West Gojam, Ethiopia, found no association between mode of delivery and PNM; the risk of PNM among spontaneous vaginal deliveries were not different from deliveries via caesarean section (COR=0.34, 95% CI: 0.11, 1.10).

Another study also found delivery via breech extraction (OR, 3.59; CI, 1.89 – 6.84) and delivery by caesarean section (OR, 2.39; CI, 0.76 – 7.59) to increase the odds of perinatal mortality. However, spontaneous labour (OR, 0.16; CI, 0.02 – 0.89) reduced the risk of perinatal mortality (Tachiweyika et al., 2011).

2.6.3 Referral diagnosis and perinatal mortality

A study of obstetric emergency referrals to a teaching hospital in Western Nigeria found obstetric emergencies to have accounted for 86% of perinatal mortalities over the study period. The most common indications for the referrals in this study included prolonged or obstructed labour, post-partum haemorrhage, foetal distress, hypertensive disorders of pregnancy (severe PIH/ eclampsia) and antepartum haemorrhage (Adelaja & Taiwo, 2011). In a descriptive cross-sectional study involving 384 women in public health facilities in Kenya, obstetric emergencies were noted to contribute to PMN in the facilities (Jebet & Oyore, 2015).

In a household survey of 6,285 women in Bangladesh on outcomes of last pregnancy, the highest risk of perinatal mortality was associated with antepartum haemorrhage (IRR = 3.5, 95% CI: 2.4–4.9 for perinatal deaths). Pregnancy-Induced hypertension was significantly associated with stillbirths (IRR = 1.8, 95% CI 1.3–2.5) and Probable Infection was a significant risk factor for early neonatal deaths (IRR = 1.5, 95% CI 1.1–2.2) (Khanam et al., 2017). In a secondary review of perinatal records in Mpumalanga, South Africa, maternal complications accounted for 50.4% of macerated stillbirths, 50.7% of fresh still births and 25.8% of early neonatal deaths. Maternal hypertension ($p < 0.01$) and obstetric haemorrhage ($p < 0.01$) were significant risk factors for stillbirths and early neonatal deaths; live births were more likely to have a mother with no obstetric complication ($p < 0.01$) (Allanson, Muller, & Pattinson, 2015). APH (OR=5.60, CI (2.21 – 14.57)) and Pregnancy-induced hypertension (PIH) (OR=4.81, CI (2.59 – 8.99)) were found by Tachiweyika et al. (2011) to increase the risk of PNM.

A Kenyan cross-sectional study involving 910 births showed that complications associated with labour such as haemorrhage, premature rupture of membranes/premature labour, and obstructed labour/malpresentation increased the risk of PNM between 8- and 62-fold. Also, 53% of all PNMs were attributable to labour complications (Weiner et al., 2003).

A case control study in Zimbabwe also showed an increased risk of PNM with mothers who experience labour complications [OR=7.56 (4.38-13.06)] compared to those who did not (Tachiweyika et al., 2011).

2.6.4 Fetal factors

Sex: Sex of the baby was not significantly associated with perinatal mortality in a case-control conducted at Alexandria, Egypt. Males were just as likely to experience PNM compared to females (OR=0.7, 95% CI: 0.4–1.1) (Hassan et al., 2012).

Birthweight: In case control study to determine risk factors for perinatal mortality at the Hawassa University hospital, Ethiopia, conducted between 2008 and 2010, adjusted odds ratios from binary logistic regression showed significantly elevated odds of perinatal mortality among birthweights less than 1.5kg (AOR, 16.2; 95% CI, 6.06-43.02) and those between 1.5kg to 2.49 kg (AOR, 1.7; 95% CI, 0.95-2.97) compared to normal birth weight of 2.5-4.00 kg. There was no significant association between birthweight >4.00kg and perinatal mortality (AOR, 0.9; 95% CI, 0.62-1.49) (Bayou & Berhan, 2009). Similarly, in a case control study conducted in 2009 at Marondera District, Zimbabwe, having a birth weight below 2.5 kg was found to significantly increase the odds of perinatal mortality (AOR, 9.46; 95% CI; 3.91-27.65) (Yirgu et al., 2016). A previous case-control study still within Marondera District in Zimbabwe found having a birth weight below 2500g [AOR=9.46 (3.91-27.65)] as an independent determinant of PNM (Tachiweyika et al., 2011).

Gestational age: In a population based nested case-control study on determinants of perinatal mortality in West Gojam Zone, Ethiopia, on binary multivariable logistic regression analysis, preterm babies were found to be more at risk for perinatal mortality (AOR, 9.44; 95% CI 1.81–49.22) compared to term babies (Yirgu et al., 2016). Similarly, another case control study in Zimbabwe showed increased risk of PNM among preterm babies [OR=15.06 (8.24-27.54)] compared to term babies (Tachiweyika et al., 2011). A case-control study conducted at Hawassa University Hospital, Ethiopia, also found preterm birth to be a significant independent predictor of PNM (AOR, 3.8; 95% CI, 2.73-5.28) (Bayou & Berhan, 2009).

2.6.5 Independent Predictors of PNM

Risk factors independently associated with PNM from other studies are presented below.

In the WHO survey of maternal and perinatal deaths in Nigeria, multivariate regression analysis of the risk factors for PNM, at a significance level of 0.05, the following factors were

considered to independently predict PNM: maternal age 26- 30 years, and maternal age >40 years; lack of Antenatal clinic visits (ANC); prematurity; asphyxia; mode of delivery; mother's level of education; and unbooked status (Umezulike, 2011).

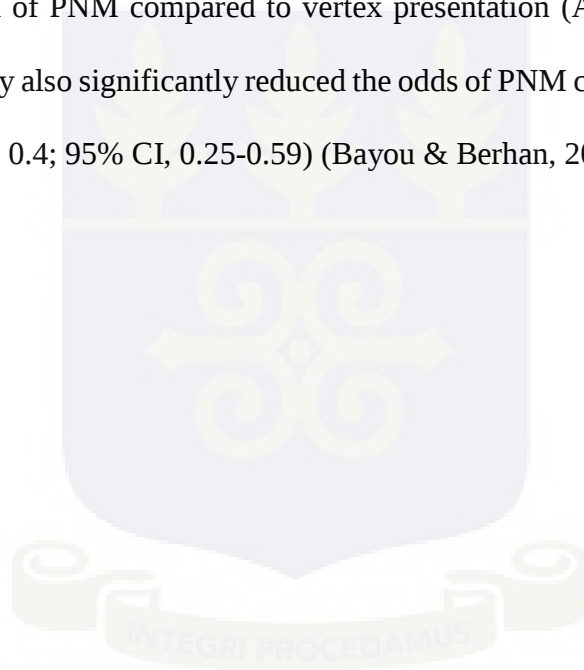
In a case-control study in Egypt, on stepwise logistic regression analysis, these five factors were the most significant ($p<0.05$) predictors of PNM: maternal age, past history of PNM, parity, frequency of ANC visits and index pregnancy complications. The following had higher risks of PNM: very young or very old mothers (OR=4.1 and 6.46, respectively), history of PNM (OR=12.7; 95% CI: 5.04–29.54), multiparity (OR=2.23; 95% CI: 1.50–5.42), low ANC visits (OR=3.88; 95% CI: 2.26–6.65), and history of complications in index pregnancy (OR=9.21; 95% CI: 3.40–24.95) (Hassan et al., 2012).

Independent predictors of PNM identified by stepwise logistic regression analysis in a case control study in Zimbabwe include: experiencing labour complications [AOR=8.99 (3.11-25.98)], antenatal care booking [AOR=0.32 (0.18-0.87)] and birth weight below 2500g [AOR=9.46 (3.91-27.65)] (Tachiweyika et al., 2011).

In a nested population based case-control study in Ethiopia, the following factors were identified to be independently associated with PNM after multivariate logistic regression analysis, with $p<0.05$ considered as significant: new-born from families in the second quintile of the wealth index were less likely to experience PNM compared to the lowest quintile (AOR = 0.38, 95% CI 0.16–0.93) ; increased odds of PNM among new-borns from primiparas than grand multiparas (AOR = 3.15, 95% CI 1.03–9.60). Also, mothers with history of APH had increased odds of PNM (AOR = 9.55, 95% CI 4.67–19.54) as well as preterm babies (AOR = 9.44, 95%CI 1.81–49.22) than term new-borns (Yirgu et al., 2016).

A case control study conducted between 2008 and 2010 to determine risk factors for perinatal mortality among deliveries at the Hawassa University hospital, Ethiopia, adjusted odds ratios obtained by binary logistic regression analysis showed that obstructed labour (AOR, 19.8;

95%CI, 7.58-51.90) , antepartum haemorrhage (AOR, 12.2; 95% CI, 4.70-31.71) , hypertensive disorders of pregnancy (AOR, 3.2; 95% CI,1.33-7.53), malpresentation (AOR, 1.83; 95% CI, 0.68-4.91), cord accidents (AOR, 15.9; 95% CI, 4.28-59.1) were significant ($p<0.05$) independent predictors for high perinatal mortality. They increased risk of PNM compared to absence of these complications. In the same study, birth weights of $< 1.5\text{kg}$ and $1.5\text{-}2.49\text{kg}$ were independent predictors of PNM; they increased the odds of PNM compared with birth weight between $2.4\text{-}4.0\text{kg}$ [(AOR, 16.2; 95% CI, 6.06-43.02) and (AOR, 1.7; 95% CI, 0.95-2.97) respectively]. Malpresentation was also found to be an independent predictor ($p<0.05$), increased risk of PNM compared to vertex presentation (AOR,1.8; 95% CI, 0.93-3.66). Caesarean delivery also significantly reduced the odds of PNM compared to spontaneous vaginal delivery (AOR, 0.4; 95% CI, 0.25-0.59) (Bayou & Berhan, 2009).



CHAPTER THREE

METHODS

3.0 Introduction

This chapter presents the methods employed in the conduct of this study. The chapter is presented in sections. The sections are study design, study area, study population, sample size determination and calculation, sampling technique, inclusion and exclusion criteria, study variables, definition of some study variables, data collection methods and tools, data quality control measures, data entry and validation, data analysis and ethical considerations.

3.1 Study design

A descriptive cross-sectional study which used quantitative methods of data collection.

3.2 Study area

The study was carried out in four hospitals located in the Accra and Tema Metropolis of the Greater Accra Region of Ghana.

The Greater Accra Region has a 2017 projected population size of about 4.9 million. It has the least land area in the country and a high population density. The region's population has a youthful structure (Bentsi-Enchill, Cudjoe, Sepah, Anarfi, & Gaisie, 2013). The region has a doctor to patient ratio of 1:1651 (Ghana Health Service, 2015). Eighty percent of births in the region are attended by skilled attendants, 100% of health facilities are powered by electricity and it has the highest number of midwives (15) attending deliveries (1000). It however has the biggest gap in the distribution of comprehensive emergency obstetric care (cEmOC) facilities (i.e. actual number of facilities per 200, 000 population)(Ghana Ministry of Health, 2011).

The four health facilities in which data was collected include the Greater Accra Regional Hospital, Tema General Hospital, La General Hospital and Ledzorkuku Krowor Municipal Assembly (LEKMA) hospital. All four hospitals are Ghana Health Service facilities, and they

all provide cEmONC services, 24 hours a day, 7 days a week, and have functional telephone lines. All of them are also secondary level health facilities. They all receive referrals from all levels of the healthcare delivery system; horizontal as well as vertical referrals. They also receive referrals occasionally from Tertiary Facilities such as the 37 Military Hospital in Accra, and the Korle-Bu Teaching Hospital, Accra. All the four facilities have a triage area and obstetrics and gynaecology emergency unit.

Emergency referrals from other health facilities are seen at the following units of each of the hospitals: the emergency unit, the triage rooms, the labor wards or the Antenatal Clinics. Each of the hospitals run on electricity, and have back-up power supply (generators). Data on numbers of emergency referrals received were unreliable in each of the facilities. All the hospitals have all cadres of health workers, including specialist obstetrician and gynecologists, pediatricians, midwives among others. Each of the facilities have a functional ambulance. They also work together with the Ghana Ambulance Service.

The Greater Accra Regional Hospital is located at Adabraka, Accra. Its catchment area includes largely the Greater Accra Region and some parts of the Eastern, Central and Volta Regions. It trains House Officers in Medicine, Surgery, Obstetrics and Gynecology, dentistry and also offers training to post graduate Residents in Pediatrics, Obstetrics and Radiology. Ridge Regional Hospital is the main secondary referral hospital in Greater Accra Region providing Comprehensive Emergency Obstetric and Neonatal Care (EmONC). The hospital had a maternal death percentage of 0.4-0.5% over the years 2014-2016. It recorded 149 stillbirths, 239 macerated stillbirths and received 2,525 referrals in the year 2016 (Greater Accra Regional Hospital, 2017). In 2015, it received 4,393 referrals, constituting 52.2% of cases for the year. In 2016, the hospital conducted 7,815 deliveries, out of which 149 were stillbirths and 239 macerated stillbirths. 3,582 caesarean sections were conducted in 2016. The hospital has just had its first phase of building reconstruction completed. This includes a new ultra-modern

maternity unit and Neonatal Intensive Care Unit (NICU). One of the reasons for the renovations was to help increase the bed capacity of the hospital from 192 to 420 since it had been recording an average bed occupancy rate of 104% (Greater Accra Regional Hospital, 2017).

The Tema General Hospital is located in Tema, the industrial hub of Ghana. It is a major referral site for facilities in and around Tema. It serves a population of about 628,053. It has a total bed capacity of about 294. From the 2016 annual report, the obstetrics and gynecology department has 3 specialists, 3 medical officers, and 45 midwives. The unit has a total bed capacity of 99. It had 6,029 deliveries in 2016, still birth rate of 4.8%, PNM rate of 66 per 1000 births, and had 1311 total in-referrals (Tema General Hospital, 2017; Tema General Hospital, 2016) .

The LEKMA hospital is located at Teshie, Accra. It has a bed capacity of 110, and a catchment area of population of 257,978, with a doctor-to-patient ratio of 1:11,726. The hospital has 25 doctors (4 obstetricians), and 44 midwives. In 2016, the hospital had 1646 vaginal deliveries, and 1028 caesarean sections, 22 fresh stillbirths and 39 macerated still births. It has a stillbirth rate of 2.2 per 1000 births, infant mortality rate of 9.7 per 1000 live births. Three (3) maternal deaths were recorded in 2016 (LEKMA Hospital, 2017).

La General Hospital is located in La, Accra. It has a bed capacity of 120. The Obstetric and Gynaecological unit has a bed capacity of 40. The Unit has 1 specialist obstetrician gynaecologist and 2 medical officers. It performed 534 deliveries in 2016. Stillbirth rate was 4.0%. It received an average of 20 per month in-referrals to the triage/ emergency unit in 2016 (La General Hospital, 2017; DHIMS, 2017).

3.3 Study population

The study population were pregnant women who were referred from health facilities on account of one or more obstetric emergency(ies).

3.4 Sample size determination and calculation

The sample size for the study was calculated using the Cochran formula $n = Z^2 \times PQ/d^2$, where n represents the desired minimum sample size, Z is the normal standard deviate, whose value at 95% confidence level is 1.96, P is the prevalence of perinatal mortality among referred obstetric emergencies and Q = 1-P.

The sample size was arrived using $p = 0.187$, derived from a study of perinatal mortality among referred obstetric emergencies conducted in Bangalore, India, where prevalence of perinatal mortality was 18.7% (Patel et al., 2012). This gave the largest minimum sample size, compared to other values of p obtained from other similar studies. Thus, inputting $p=0.187$ into the Cochran formula, a minimum sample size(n) of 234 was arrived at. This was scaled up to 240.

3.5 Sampling technique

A purposive sampling technique was used. Health facilities were selected based on whether or not they offered cEmONC, are referral centers and also based on location in the Metropolis, to ensure hospitals selected were well distributed in the Accra and Tema Metropolis. Candidates who met the selection criteria for the study, and were also willing to participate in the study were recruited on a daily basis till the sample size of 240 was reached.

3.6 Inclusion and exclusion criteria

Pregnant women who were referred from one health facility to any of the study sites were eligible to participate in the study.

Inclusion criteria: The referred pregnant women however had to further meet the following inclusion criteria:

- Gestational age of fetus calculated from last menstrual period or first early ultrasound scan of 28 weeks or more
- Delivered at referral facility or before arrival
- Primary diagnosis constitutes an obstetric emergency, and must be same at both referring and receiving health facility.

Exclusion criteria: Referred obstetric emergencies with the following characteristics were however excluded from the study:

- Self-referrals
- Referrals in the post-partum period
- Multiple gestation pregnancies

3.7 Study variables

Dependent (outcome) variable: Perinatal mortality

Independent variables:

- Socio-demographic characteristics: age, marital status, employment status, educational level, average monthly income
- Maternal factors: Parity, number of ANC attendance, history of previous PNM, mode of delivery
- Fetal factors: sex, birthweight, gestational age
- Referral factors: means of transport, interfacility communication, accompanied by health worker, number of facilities visited, prior home visit, non-clinical referral

- Time factors (proxy to access to cEmOC): exit time, travel time, waiting time, Decision-to-Delivery Interval (DDI) (for cases ending in emergency caesarean section delivery)

3.8 Definition of some of the variables

Dependent variable:

Perinatal mortality: still births (fetal death occurring after 28 weeks gestation) or neonatal deaths occurring within the first week of life as defined by WHO (World Health Organization, 2006b).

Independent variables:

Parity: Number of pregnancies carried to viable gestational age (≥ 28 weeks).

Gestational age (in weeks): Calculated either from last menstrual period or from early ultrasound scan.

Interfacility communication: Notification of receiving facility of a referral by the referring facility via any means.

Number of facilities visited prior: Number of health facilities visited from referral from first health facility till admission at receiving facility.

Prior home visit: Patient visiting home after referral before arrival at receiving health facility.

Non-clinical referral: Referring hospital has capacity to treat/ manage the patient but refers due to factors such as non-availability of doctor, no blood type, lack of supplies like oxygen etc.

Exit time: Time interval from patient notification of referral to the time of leaving the referring health facility.

Travel/ transport time: Time interval from leaving the first referring facility to arrival at receiving health facility.

Waiting time: Time taken at receiving facility before being attended to by doctor or midwife (from arrival to start of care provision).

Decision-to-Delivery- Interval/ Time (DDI): Time from decision to perform emergency c/s to time when baby is delivered.

3.9 Data collection techniques and tools

Data was collected by the Principal investigator and research assistants using a structured interviewer-administered questionnaire with verification of responses from patient's medical records (patient folder, antenatal record booklet, NICU folders, accompanying referral letters etc.) (data abstraction) and from clinicians, relative(s) and caregiver interviews. The questionnaire was informed by a model developed by Thaddeus and Maine to explain delays contributing to maternal mortality in developing countries, as well as insights from other studies on this topic. The questionnaires were administered in the language preferable and which was well understood and spoken by the patient/ others. In cases where the language of choice was not English, verbal translations were carried out. Translators used were care providers directly involved in the care of the patient or the study research assistants. Patients discharged before the 7th day after birth were followed up on the phone to determine foetal outcome on the 8th day after delivery. Data collection period was from April to July 2017.

Data such as that on reason for referral, referral diagnosis, provision of contact information of referral facility/ health worker and type of healthcare worker making the referral were verified from the patient's referral form (if came with one) and/or from the patient's folder. Fetal outcomes were verified from the mother's folder, ANC booklet, delivery card or from the

newborns medical records at NICU if admitted there. Time measures (such as referring time, waiting time etc.) may be verified from the referral forms as well as the patient folders. Clinician on duty at time of referral were asked whether or not he/she was informed/notified of referral by referring facility prior to arrival of patient. The women were interviewed upon discharge from the receiving health facility.

Prior to data collection, research assistants, all of whom were midwives, were recruited and trained. The training covered the purpose of the study, various aspects of administration and completion of the questionnaires, translation of medical terms into key local languages (Ga, Ewe and Twi), how to handle unresponsive interviewees as well as ethical considerations.

Also, the questionnaire was tested by the principal investigator (PI) among 10 women at the Ga South Municipal Hospital (not part of the study sites), McCarthy Hill, Accra, prior to commencement of data collection. Feedback from the pre-testing was used to adapt the questionnaire. The following adaptations were effected: inclusion of number of facilities visited prior to admission at the receiving facility and reason for non-admittance at the prior facility(ies).

3.10 Data quality control measures

The following measures were undertaken to ensure quality data. Research assistants were supervised during the data collection processes. Samples of completed questionnaires were taken every 5th day of data collection and assessed for errors, omissions, eligible entries among others. Corrective measures were taken and communicated to the research assistants to ensure non-repetitions of mistakes. This was done till the sample size was reached. Questionnaires that could not be redeemed were discarded appropriately.

3.11 Data entry and validation

Data entry template was created using SPSS version 22. Data was coded numerically. Data entry was done upon receipt of filled questionnaires to avoid too many entries at a go with its associated risk of error entries. Each data entered per patient was double checked before that of the next patient was entered. Data view was glanced frequently, as well as descriptive analysis, to ensure there were no missing values and to detect wrong entries.

3.12 Data analysis

Data was exported from SPSS into Stata version 13 for analysis. Univariate analysis was first carried out for all the independent and intermediate variables. Categorical variables were described and expressed as frequencies and relative frequencies. Continuous variables were expressed as means (standard deviation) or median (interquartile range). Simple logistic regression analysis was used to identify factors associated with PNM. $P < 0.05$ was considered significant. Significant variable from the simple logistic regression were entered into a multivariate logistic regression model. Odds ratios and adjusted odds ratios were calculated to determine factors independently associated with perinatal mortality among the referred obstetric emergencies. The results were presented in charts and tables.

3.13 Ethical considerations

Ethical clearance was obtained from the Ghana Health Service Ethical Review Committee before commencement of the study (GHS-ERC: 52/12/2016). Permission was also obtained from the leadership of the Greater Accra Regional Health Directorate, Directors/ Medical superintendents of the four hospitals, Heads of the Obstetric units, head of nursing services of the obstetric units of the various hospitals, public health units as well as the records units.

Informed consent was obtained from all after the objectives and the methodology of the study was explained to them. Consent was indicated by signing or thumb printing on the questionnaire form. Participation was voluntary, no coercive means was used. Patients were made aware that refusal to participate in the study was not going to affect the quality of care she will receive at the hospital.

Privacy and confidentiality of every participant was ensured throughout the study period and beyond. Interviews were conducted in private comfortable rooms. Participants were addressed in a language that he/she understood. Interpreters who were not research assistants or directly involved in the care of the patient were not engaged. Telephone numbers of participants were obtained solely for the aim of providing feedback on progress and outcome of research, for provision of support with respect to health education and for obtaining any additional information when necessitated. Participants were identified by codes on the questionnaires. Data entries were stored electronically on the principal investigator's (PIs) computer which was/is password protected. Hard copies of filled questionnaires were only accessible to the PI and others involved directly in the study. The results of this study will be disseminated in such a manner that no information will be linked to the identity of any participant.

The study has no direct benefit to participants however, results of the study will aid efforts at improving or solving referral challenges encountered by patients.

There were no major risks associated with the study. Minor risks however included patients or their relations who became emotional or distraught during interview sessions, particularly those with still births, early neonatal deaths, severe maternal illness and other undesirable outcomes. Such participants were given the opportunity to decline answering questions they regarded as sensitive or withdraw from the study altogether even after initial consent has been given.

Psychological support was also provided to such participants by a clinical psychologist, Miss Maura Ntow and team, mostly through empathetic listening and reassurance.



CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter presents the result of the study. It provides information on the socio-demographic characteristics of the women referred on account of obstetric emergencies, reasons for the referrals, the referral, fetal, maternal as well as the time factors. The chapter ends with results of multivariate analysis showing the factors independently associated with perinatal mortality among the referred clients.

4.1 Socio-demographic characteristics of respondents

A total of 240 mothers participated in the study. Table 1 shows the socio-demographic characteristics of the respondents.

More than half (56.7%) of the respondents were in the age group 30-39 years. The mean age of the respondents was 30 years $SD \pm 6$ years. More than three-quarters (79.2%) of the mothers were married while 15.8% were single. Most of them (54.2%) were traders while 5.0% were students. Most of the referred mothers had formal education (86.7%) as opposed to few (13.3%) who had no formal education.

Table 1: Socio-Demographic Characteristics of Respondents

Characteristics	Frequency	Percent (%)
Age of respondents (in years)		
<20	10	4.2
20-29	86	35.8
30-39	136	56.7
>40	8	3.3
Marital status		
Single	38	15.8
Married	190	79.2
Co -Habiting	12	5.0
Occupation		
Unemployed	30	12.5
Students	12	5
Trader	130	54.2
Artisan	42	17.3
Other	26	10.8
Educational level		
No Formal Education	32	13.3
Primary	26	10.8
Junior High School (JHS)	94	39.2
SHS/Vocational/Technical	68	28.2
Tertiary	20	8.3
Average monthly income		
None (0)	44	18.3
Up to 300 Cedis	106	44.2
>300 Cedis	90	37.5

SHS= Senior High School

4.2 Maternal and Fetal characteristics of respondents

4.2.1 Maternal factors of respondents

Almost half (47.5%) of the respondents were multiparous women, while grand multiparous women constituted 4.2% of the emergency referrals (Table 1). More than three-quarters (79.2%) of the respondents had attended ANC four and more times. Majority of the respondents (91.7%) had no history of PNM. Most of the referred clients were delivered via caesarean section (79.2%), only a few delivered vaginally (20.8%). None of them underwent assisted vaginal delivery. Table 2 shows the maternal with fetal characteristics of the respondents.

4.2.2 Fetal factors among respondents

A little above half of the babies were male (56.7%). Most of the respondents (74.2%) had babies with normal birth weight of 2.5kg to 4.0kg (Table 2). Sixty percent (60%) of the deliveries occurred at term gestation (37-40 Weeks).

Table 2: Maternal and foetal characteristics of respondents

Characteristics	Frequency	Percent (%)
Maternal Factors		
Parity		
Nulliparous	56	23.3
Primiparas	60	25
Multiparous	114	47.5
Grand multiparous	10	4.2
Number of ANC Attendance		
<4 times	50	20.8
>= 4 times	190	79.2
History Of PNM		
Yes	20	8.3
No	220	91.7
Mode of Delivery		
Vaginal delivery	50	20.8
Caesarean section	190	79.2
Fetal Factors		
Sex of Baby		
Male	136	56.7
Female	104	43.3
Birth Weight		
<2.5kg	52	21.7
2.5-4kg	178	74.2
>4kg	10	4.2
Gestational Age		
Preterm	74	30.8
Term	144	60
Post Term	22	9.2

4.3 Referral characteristics

The predominant means of transport among the referred clients was taxi (64.2%). Only a few came via ‘trotro’ (4.2%). About 11.7% came in an ambulance. Means of transport is shown in figure 2.

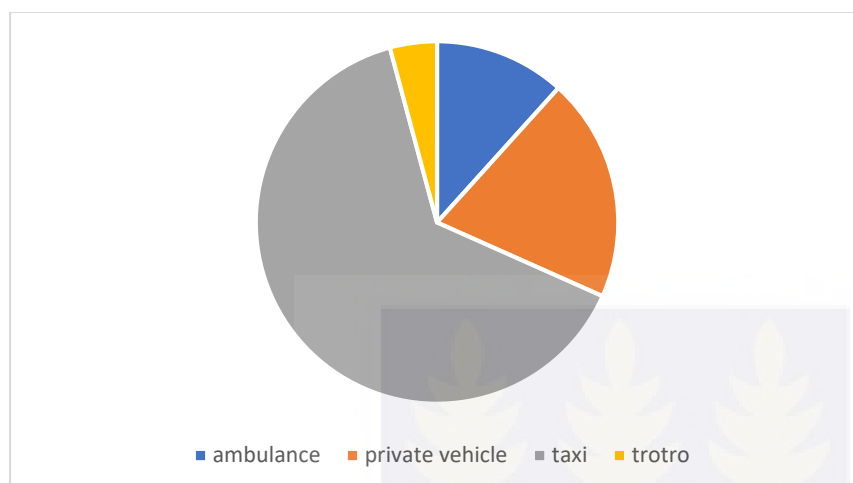


Figure 2: Means of transport of referred obstetric emergencies, Greater Accra, April-July, 2017

Majority (93.3%) of respondents found it easy obtaining a vehicle from the referring facility to the receiving facility (Table 3).

Eighty six percent (86.0%) responded that the road en-route to the receiving facility was good (Table 3).

Although most (80.8%) of the referred emergencies moved directly from the referring facility to the receiving facility, a few (19.1%) had to pass through one or more health facility(ies) before admission at a receiving hospital (Table 3). Reasons given for non-admittance at the intervening facilities were: no bed (71.4%), no blood or blood type (9.5%) while 4.7% did not know why they were refused admission. About 14.3% however were due to other reasons such as inability to afford charges at the intervening referring facility and self-request (Not reported in Table).

Table 3: Referral characteristics of respondents

Characteristics	Frequency	Percent (%)
Referral System factors		
Transport means		
Ambulance	28	11.7
Private Vehicle	48	20
Taxi	154	64.2
“Trotro”	10	4.2
Ease of Transport		
Easy	224	93.3
Difficult	16	6.7
Nature of Road		
Good	208	86.7
Bad	32	13.3
Interfacility communication		
Yes	70	29.2
No	170	70.8
Accompanied by HW		
Yes	108	45
No	132	55
Number of Prior Facilities Visited		
None	194	80.8
One	26	10.8
Two or more	20	8.3
Prior Home Visit		
Yes	20	8.3
No	220	91.7
Non -Clinical Referral		
Yes	40	16.7
No	200	83.3
Referral Letter		
Yes	222	92.5
No	18	7.5

HW= Health worker

4.3.1 Adherence to referral guidelines

There was no inter-facility communication between the referring facility and the receiving facility in most of the referrals (70.8%) (Table 3).

A little over half of the respondents (55.0%) were not accompanied by a HW when they were referred (Table 3).

Most of the respondents (92.5%) came to the receiving facility with accompanying referral letters.

Of those who came with referral letters, 63.9% used the Ghana Health Service referral forms, 22.7% used their facility's referral forms, 11.3% had the referral notes written in the ANC booklet while 2.1% had the referral note written on a plain sheet of paper. For 19.1% of the referred cases, whether treatment was given or not was not written/ indicated on the referral forms (Not reported in the table).

4.4 Time factors

The mean exit time was 1hour SD $\pm$ 2.7 hours. The median transport time was 0.75 hours (0.42-1.0 hours). The mean waiting time was 0.87 hours SD $\pm$ 1.17 hours. The mean Decision to Delivery Interval (DDI) was 6.96 hours SD $\pm$ 10.45 hours. Only 13.3% of clients scheduled for emergency c/s had DDI of 30 minutes or less. Majority (86.3%) had DDI greater than 30 minutes.

4.5 Reasons for referrals

All the respondents were referred on account of one obstetric emergency or another (clinical reason). However, 16.7% were referred due to non-clinical reasons.

4.5.1 Clinical reasons for referrals

Clinical indications for referrals are shown in figure 3. Most of the clients (38.3%) were referred on account of PIH (pre-eclampsia/ eclampsia). About 12.8% were referred due to fetal distress and 12.2% due to other reasons such as 1 previous c/s, short interpregnancy interval in labor; big baby in labor; premature rupture of membranes with severe oligohydramnios; severe anemia in labor. Most of the referred clients had more than one diagnoses.

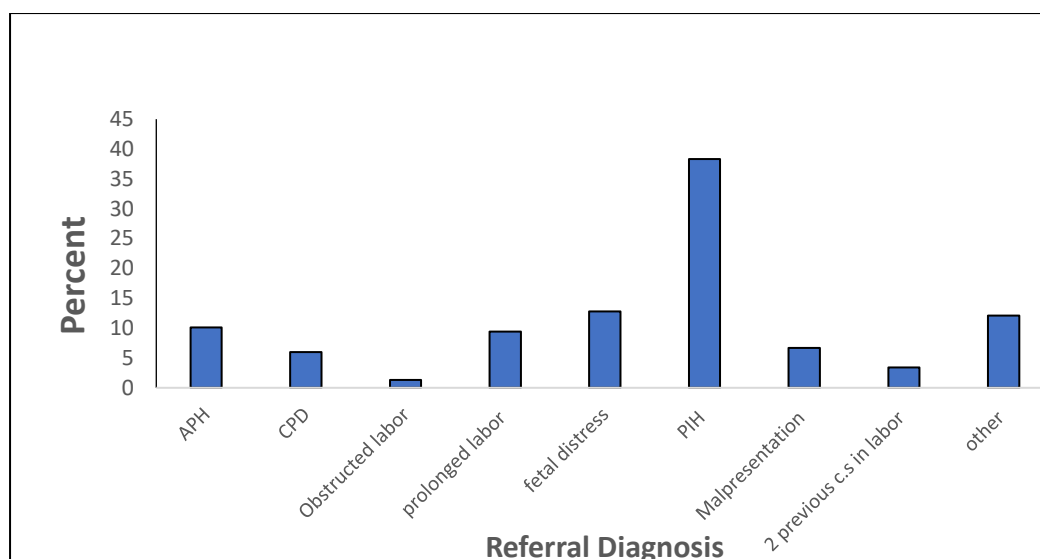


Figure 3: Bar chart showing clinical indications for obstetric emergency referrals to four facilities in the Accra and Tema Metropolitan Areas (April-July, 2017).

4.5.2 Non- clinical reasons for referrals

About 30.0% of the non-clinical referrals were due to non-availability of a doctor or midwife at the referring facility, 20.0% due to non-availability of bed space, 20.0% due to non-availability of blood/ blood group type, 15.0% due to non-availability of instruments/ supplies and 15% due to inability of client to pay for services at the referring facility [About 35.0% of clients were referred from private health facilities (including CHAG facilities) while 65.0% came from Public/ Government facilities (28.3% polyclinics, 13.3% from district/ municipal hospitals, 7.5% maternity homes and 5.0% from Korle-Bu Teaching Hospital)].

4.6 Prevalence of perinatal mortality

Forty-two babies (17.5%) were stillborn, and 10 (4.2%) had early neonatal death. Twelve of the 42 still births were macerated stillbirths (28.6%). All the early neonatal deaths were due to severe birth asphyxia. Prevalence of PNM among the referred obstetric emergencies was 21.7% (217 per 1,000 births).

4.7 Factors associated with PNM

4.7.1 Socio-demographic factors associated with PNM

The socio-demographic factor found to be significantly associated with PNM on simple logistic regression was marital status ($p=0.007$). The odds of PNM was 2.58 times higher in unmarried women compared to married women (COR=2.58; 95%CI: 1.30-5.13). Maternal age, employment status, educational level and income level were all not significantly associated with PNM ($p>0.05$) (Table 4).

Table 4: Socio-demographic factors associated with PNM on simple logistic regression

Variable	COR (CI)	P-Value
Age		
<30 years (Ref)		
≥30 years	1.34 (0.71-2.50)	0.371
Marital Status		
Married(Ref)		
Not Married	2.58 (1.36-5.127)	0.007
Employment Status		
Employed(Ref)		
Unemployed	0.52 (0.21-1.30)	0.158
Educational Status		
None -Basic(Ref)		
Above Basic	1.08 (0.52-2.23)	0.836
Average Income Level		
None(Ref)		
Up To 300	1.85 (0.70-4.91)	0.214
>300	2.05 (0.76-5.49)	0.154

CI = Confidence interval

COR = Crude odds ratio

Ref= Reference group

4.7.2 Maternal factors associated with PNM

Only one out of the 4 maternal factors evaluated was significantly associated with PNM. Number of ante-natal attendance was found to be significantly associated with PNM ($p<0.001$). Mothers who attend ANC four or more times have reduced odds of PNM compared to mothers attending ANC less than 4 times (COR=0.11; 95%CI: 0.06-0.23).

Parity, history of PNM and mode of delivery were all not significantly associated with PNM ($p < 0.05$). The COR and 95% CI are shown in table 5.

Table 5: Maternal factors associated with PNM on simple logistic regression

Variable	COR(CI)	P-Value
Parity		
Nullip(Ref)		
Primip	1.15(0.45-2.92)	0.769
Multip	1.47(0.66-3.26)	0.346
Number of ANC Attendance		
<4 Times(Ref)		
≥4 Times	0.11(0.06-0.23)	0.000
Mode of Delivery		
SVD (Ref)		
C/S	1.58(0.69-3.62)	0.277

CI= Confidence interval

COR= Crude odds ratio

Ref= Reference group

4.7.3 Fetal factors associated with PNM

Birthweight ($p=0.001$) and gestational age ($p=0.045$) were the fetal factors found to be significantly associated with PNM. The odds of PNM among birthweights $\geq 2.5\text{kg}$ was 67 times less compared to birthweights less than 2.5kg (COR=0.33; 95%CI: 0.17-0.65). Also, the term/ post-term babies had reduced odds of PNM compared to preterm babies. Term/ post-term babies are almost twice less likely to experience PNM compared to term babies (COR= 0.52, 95% CI: 0.28-0.99).

There was however no significant association between sex of the baby and PNM ($p>0.05$).

Table 6 shows the association between fetal factors and PNM.

Table 6: Foetal factors associated with PNM on simple logistic regression

Variable	COR(CI)	P-Value
Sex		
Male(Ref)		
Female	0.77(0.41-1.45)	0.774
Weight		
<2.5kg(Ref)		
≥2.5kg	0.33(0.17-0.65)	0.001
Gestational Age		
Preterm		
Term-Post Term	0.521(0.28-0.99)	0.045

CI= Confidence interval

COR= Crude odds ratio

Ref= Reference group

4.7.4 Referral factors associated with PNM

Means of transport and being accompanied by a HW were the only referral factors found to be significantly associated with PNM ($p=0.005$ and $p=0.039$ respectively). Referrals transported via public/ private vehicles had reduced odds of PNM compared to those transported by an ambulance (COR= 0.31; 95%CI: 0.14-0.71). Compared to those accompanied by a HW, those who were not accompanied by a HW were 0.48 times less likely to experience PNM (COR= 0.52; 95%CI: 0.28-0.97).

No association was found between the following referral factors and PNM: ease of obtaining transportation, nature of road, interfacility communication, number of HF visited prior, prior home visit, non-clinical referral and referrals with referral letters.

The associations between referral factors and PNM is shown in table 7.

Table 7: Referral factors associated with PNM on simple logistic regression

Variable	COR(CI 95%)	P-Value
Means Of Transport		
Ambulance		
Public/Private	0.031(0.14-0.71)	0.005
Transport Ease		
Easy(Ref)		
Difficult	0.00(0.00)	0.998
Nature Of Road		
Good(Ref)		
Bad	1.80(0.79-4.08)	0.162
Interfacility Communication		
Yes(Ref)		
No	0.907(0.47-1.77)	0.774
Accompanied By HW		
Yes(Ref)		
No	0.52(0.26-0.97)	0.039
Number of Facilities Visited		
None(Ref)		
One	0.66(0.22-2.01)	0.497
More Than Two	1.55(0.56-4.28)	
Prior Home Visit		
Yes(Ref)		
No	0.62(0.23-1.69)	0.349
Non-clinical Referral		
Yes(Ref)		
No	1.13(0.33-3.29)	0.779
Referral Letter		
Yes(Ref)		
No	1.04(0.33-3.29)	0.953

CI= Confidence interval

COR= Crude odds ratio

Ref= Reference group

4.7.5 Time factors associated with PNM

None of the time factors (exit time, travel time, waiting time and DDI) were found to be significantly associated with PNM on simple logistic regression.

Table 8 shows the various time factors, 95% CI and their respective p-values.

Table 8: Time factors associated with PNM on simple logistic regression

Variable	COR(CI)	P-Value
Exit Time	0.99(0.79-1.11)	0.442
Transport Time	1.14(0.97-1.34)	0.121
Waiting Time	0.76(0.53-1.10)	0.144
DDI	0.97(0.92-1.02)	0.192

COR= Crude odds ratio

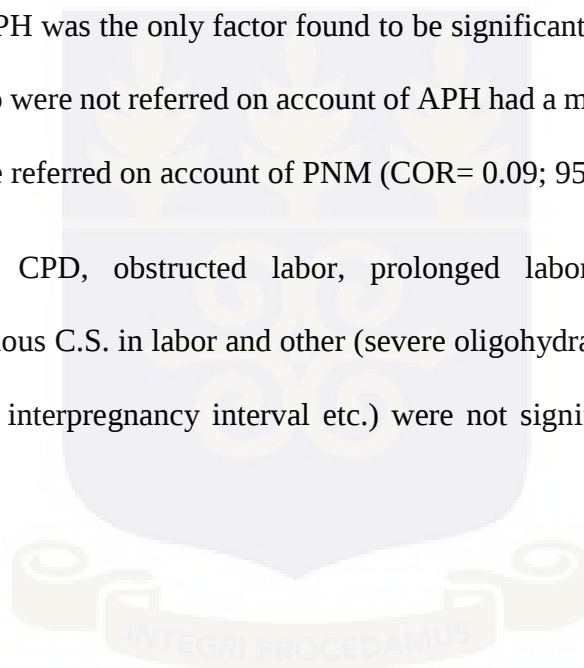
CI= Confidence interval

DDI= Decision-to-delivery interval

4.7.7 Referral diagnosis and PNM

Referral diagnosis of APH was the only factor found to be significantly associated with PNM ($p < 0.001$). Mothers who were not referred on account of APH had a markedly reduced odds of PNM compared to those referred on account of PNM (COR= 0.09; 95%CI: 0.04-0.21).

Referral diagnosis of CPD, obstructed labor, prolonged labor, fetal distress, PIH, malpresentation, 2 previous C.S. in labor and other (severe oligohydramnios, active labor in 1 previous c.s with short interpregnancy interval etc.) were not significantly associated with PNM.



4.7.8 Factors independently associated with PNM**Table 9: Factors associated with PNM among the referred obstetric emergencies on multivariate logistic regression**

Variable	COR(95% CI)	P- Value	AOR(95% CI)	P-Value
Marital Status				
Married(Ref)				
Not Married	2.58(1.36-5.127)	0.007	2.37(0.96-5.67)	0.061
Means Of Transport				
Ambulance(Ref)				
Public/Private	0.31(0.41-0.71)	0.05	0.81(0.25-2.67)	0.729
Accompanied by HW				
Yes(Ref)				
No	0.52(0.28-0.97)	0.039	0.32(0.12-6.85)	0.023
Number Of ANC Attendance				
<4 Times(Ref)				
>= 4 Times	0.11(0.06-0.23)	0.000	0.11(0.04-0.28)	0.000
Birth Weight				
<2.5kg(Ref)				
>=2.5kg	0.33(0.17-0.65)	0.001	0.58(0.09-3.60)	0.556
Gestational Age				
Preterm(Ref)				
Term-Post Term	0.52(0.28-0.99)	0.045	1.30(0.24-7.12)	0.766
APH				
Yes(Ref)				
No	0.09(0.04-0.20)	0.000	0.12(0.05-0.32)	0.000

AOR= Adjusted odds ratio

APH= Antepartum hemorrhage

CI= Confidence interval

COR= Crude odds ratio

HW= Health worker

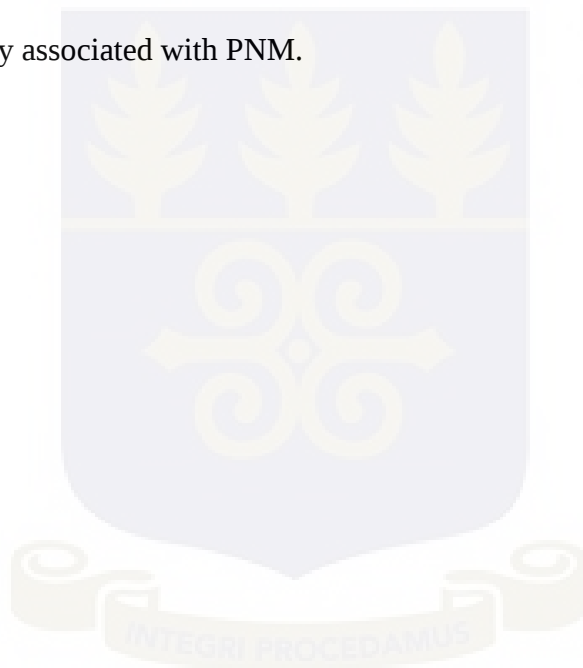
Ref= Reference group

On entering the significant factors identified from the simple logistic regression into a multivariate logistic regression model, the following factors were found to be independently associated with PNM among the referred obstetric emergencies: Accompanied by HW($p=0.023$), number of ANC attendance ($p<0.001$) and Antepartum Hemorrhage (APH)

($p < 0.001$). Not accompanied by a HW, attending ANC four or more times and not referred on account of APH independently reduces the odds of PNM [(AOR=0.32; 95%CI:0.12-0.85), (AOR=0.11; 95% CI:0.04-0.28) and (AOR=0.12; 95% CI: 0.05-0.32) respectively.

The risk of PNM among those unaccompanied by a HW and those who were not referred on account of APH increased while that of ANC visits 4 and more times remained fairly stable after controlling for the other significant variables from the simple logistic regression.

Marital status, means of transport, birthweight and gestational age were however found not to be independent predictors of PNM among the referred obstetric emergencies. Table 9 shows the factors independently associated with PNM.



CHAPTER FIVE

DISCUSSION

5.0 Introduction

This chapter deliberates on the findings of this study in relation to existing literature; and is presented in accordance with the aims and objectives of the study. Sections in this chapter include reason for referrals, level of adherence to referral protocols/ guidelines, prevalence of PNM among referred obstetric emergencies, factors associated with PNM and ends with strengths and limitations of this study.

5.1 Reasons for referrals

5.1.1 Clinical referrals

This study found the commonest reason for referrals to be PIH (pre-eclampsia and eclampsia). A study by Patel et. Al (2012) in Bangalore, India, also found hypertensive disorders to be the commonest obstetric emergency referral to the Sri Bhagwan Mahaveer Jain Hospital. Among referrals to a tertiary care facility in Maharashtra, India, preeclampsia and related conditions were also found to be the major indication for referral (22.27%) of the cases (Rohit et al., 2016). Other studies however had dissimilar findings with regard to the commonest medical reason for referrals. Nkyekyer's study on obstetric referrals to the Korle-Bu Teaching Hospital in Accra found failure to progress as the commonest referral indication (Nkyekyer, 2000). A study in Kenya, Nairobi, found antepartum haemorrhage to be the commonest reason for referrals to the Kenyatta National Hospital (13.2%) (Njoroge, 2011). In Western India, antepartum hemorrhage also constituted the major reason for referrals (Bangal et al., 2012). These studies however did not exclude women with post-partum complications as was done in this study. This might explain the disparity in terms of the commonest reason for referrals.

Notwithstanding, the main reasons resulting in referral of women with obstetric emergencies remained same in all the above studies, and in most other studies. These include PIH, APH, prolonged labor, malpresentation, CPD, obstructed labor, oligohydramnios among a few others. Two previous c.s in labor did not feature as a main referral reason among other studies as it did in this study (Rohit et al., 2016; Bangal et al., 2012 ;Njoroge, 2011).

5.1.2 Non-clinical referrals

Non-clinical referrals, as noted in this study, was similarly observed in Nairobi, Kenya (Njoroge, 2011). Reason for non-clinical referrals was similar in this study compared with the Nairobi study on obstetric emergency referrals. The non-clinical reasons were lack of supplies, financial constraints and lack of personnel. The disparity however was with the commonest reason. While lack of doctor or midwife was the commonest non-clinical reason for referrals in this study, lack of theatre was the commonest reason in the Nairobi study (Njoroge, 2011). Such disparity may be explained in terms of differences in numbers of healthcare personnel and infrastructure between the two countries/ health facilities in the two countries (Awoonor-Williams, Phillips, & Bawah, 2015).

5.2 Adherence to referral guidelines

This study found interfacility communication between referring and receiving health facility to be poor. Most facilities (70.8%) did not notify the receiving facility prior to referral.

This study found most of the referred emergencies were unaccompanied by a health worker. The SERC initiative in the Upper East Region of Ghana also had many referred clients unaccompanied by health care personnel. Although the reason for non-accompanying of patients was not explored in this study, the reason could be similar to that observed in the appraisal of the SERC initiative. The reasons included assuming client was accompanied by another health care staff, few staff on duty, accompanying client was not beneficial to the client

among others (Patel et al., 2016). Also, high proportions of unaccompanied peripartum referrals to the Korle-Bu Teaching Hospital (54.2%) was observed in a study by Nkyekyer (2000).

Most clients in this study were first referrals. This compares to higher proportions of obstetric emergency referrals being first referrals in a study by Patel et al. (2012) in Bangalore, India. Factors accounting for the few second and beyond referrals would include lack of bed space, lack of supplies, absence of health personnel etc.

This study found that a few referred obstetric emergencies went home first, before reporting to the referral facility. Reasons for partial compliance to referral advice could be similar to reasons for non-compliance to referral advice in an Accra-based study. Reasons include lack of finances, attitudes of nurses at referral facility, fear of surgery and concern with the distance to the referral center (Nwameme et al., 2014).

Our study found that few of the referred obstetric emergencies came into referral facilities with an ambulance. This is similar to referrals received at the Korle-Bu Teaching hospital in Accra, where 72.7% of the patients came into the facility with public or private means of transport (Nkyekyer, 2000). In a national facility-based survey of EmONC in Ghana, 51% of health facilities arranged with private parties for transportation of referred obstetric emergencies, while 46% assumed the referred client will make arrangements for transportation by herself (Ghana ministry of Health, 2011). This could possibly explain the low utilization of ambulance services by referred clients. Cost may also be a consideration. The use of private and public transport during emergencies however makes giving care to the patient en-route to the referral center difficult. Also, ambulance services in the country also fall much below the current need (Afari, 2015). High levels of non-ambulance transport of emergency obstetric cases (69.34%) was also observed in Maharashtra, India (Rohit et al., 2016).

5.3 Perinatal mortality among the referred emergencies

Most of the babies of referred obstetric emergencies to the Kenyatta National Hospital were well. However, the perinatal mortality was 5.5% (Njoroge, 2011). This study also found most of the babies to be well on delivery. However, the perinatal mortality was higher in this study. The PNMR in this study was also far higher than the institutional PNMRs for the year 2015 in the four hospitals which ranged between 33-70 per 1,000 births. The high PNMR in this study compared to the Kenyan study could be due to differences in the scope of the studies, their levels and country/ facility variations in healthcare workforce and infrastructure, cultural practices etc. Clients with post-partum hemorrhage (PPH) were part of the Kenyan study. However, clients referred on account of PPH were excluded from this study. Furthermore, the Kenyatta National Hospital is a tertiary facility, while this study took place in four different secondary level facilities. PNMR and associated risk factors have been shown to differ based on the level at which care is received (Moura et al., 2014). The different times within which the study was conducted could also account for the difference in PNM rates. Lastly, the difference could also indicate different qualities of obstetric and neonatal care received by clients in these facilities, since PNMR is a cardinal indicator of quality obstetric and neonatal care (Yirgu et al., 2016). This study was among high risk pregnant mothers and deliveries. This could account for the high PNMR in this study compared to the institutional PNMRs.

A study in Bangalore, India, however had a similarly high perinatal mortality of 18.7% among referred obstetric emergencies (Patel et al., 2012). It is however known that, hospital-based studies tend to overestimate PNM rates (Yirgu et al., 2016). Also, PNM has been shown to be high among referred cases and also among women with obstetric complications/ emergencies (Tachiweyika et al., 2011).

5.4 Factors associated with perinatal mortality

From this study, simple logistic regression showed the following factors to be significantly associated with PNM: means of transport, accompanied by HW, marital status, number of ANC Visits, birthweight of newborn, gestational age and APH.

However, on multivariable logistic regression analysis, this study found the following factors to be independently associated with PNM: ANC visits, APH and accompanied by HW, 4 or more ANC visits, not referred on account of APH and not accompanied by a HW reduced the odds of experiencing PNM.

Means of transport and PNM: Transport of emergency obstetric referrals via public/ private transport reduces the risk of PNM. Literature suggests that the type/ means of transport could limit timely access to EmOC. This study found the mean exit time, mean transport and waiting times to be high. This delay in receiving care predisposes the baby to distress, leading to asphyxia (Yirgu et al., 2016). Reduced time to receiving care is known to reduce PNM. Taxi and private vehicles were the predominant means of transport among our respondents and these forms of transport are readily accessible compared to ambulances (Afari, 2015).

Marital status and PNM: This study found married women to have reduced odds of PNM compared to unmarried women (single/ co-habiting). A study in Russia also found married women to have lower risk of PNM compared to single women and those co-habiting (Usynina et al., 2017). However, a study in Uganda found no association between marital status and PNM (Nankunda, 2011). A Canadian study in which the unmarried had higher risks of PNM, found the effect to disappear upon control for birthweight. The effect of being unmarried on PNM is facilitated through a descending shift in birth weight distribution (Silins et al., 1985). Also, 'marital protection' may play a role in the low risk of PNM associated with married women, particularly in the African and Ghanaian context. Husbands and families of married

women tend to provide social, financial and psychological support to the married woman during pregnancy and also after delivery (Akinyemi, Bamgboye, & Ayeni, 2015).

Birth weight and PNM: This study found low birth weight babies to have higher odds of PNM compared normal birthweight/ macrosomic babies. This finding is consistent with findings from other studies (Bayou & Berhan, 2009; Yirgu et al., 2016; Brahmanandan et al., 2017). Most low birth weight babies are preterm. The risk of death among low birth weight premature babies is higher in the perinatal period compared to low birth weight term babies (Tachiweyika et al., 2011). This explains the finding in this study. None of the term/ post-term babies in our study had birth weight lower than 2.5kg, although a few preterm babies had normal birth weights (29.7%).

Gestational age and PNM: This study found gestational age to be associated with PNM; term/ post-term babies have reduced odds of PNM compared to preterm babies. Similar findings of increased risk of PNM among preterm births compared to term babies are stated by other studies. In a nested case-control study in West Gojam, Ethiopia, preterms were found to be at higher risk of PNM compared to term babies. Prematurity was identified to be independently associated with PNM (AOR, 9.44; 95% CI 1.81–49.22) (Yirgu et al., 2016). Similarly, another case control study in Zimbabwe showed increased risk of PNM among preterm babies [OR=15.06 (8.24-27.54)] compared to term babies (Tachiweyika et al., 2011). A case-control study conducted at Hawassa University Hospital, Ethiopia, found preterm birth to be a significant independent predictor of PNM (AOR, 3.8; 95% CI, 2.73-5.28) (Bayou & Berhan, 2009). Prematurity is known to be a high risk factor for not only PNM and perinatal morbidity, it is also associated with high mortality and morbidity in the neonatal and childhood periods, and even in adulthood (Iyoke et al., 2014). Factors contributing to PNM among preterm babies include physical and physiological underdevelopment of all the systems, predisposing them to respiratory distress syndrome, infections (pneumonia/ sepsis), brain and lung haemorrhage,

hypoglycaemia, anaemia, patent ductus arteriosus among others (Basiri, Esna Ashari, Shokouhi, & Sabzehei, 2015). Prematurity rates are increasing worldwide, including low and middle-income countries. This poses a major challenge to obstetricians and paediatricians (neonatologists) interested in reducing PNMRs (Behal & Vinayak, 2015).

ANC Visits and PNM: This study found mothers with poor antenatal care (less than 4 ANC visits) to have increased risk of PNM. This was similar to other studies. Umezulike (2011) also found poor ANC attendance to be an independent predictor of PNM, as well as Hassan et al.(2012) in a case-control study in Egypt. Nonetheless, Nankunda (2011) found no difference with regards to risk of PNM, on bivariate analysis, between those who attended, and those who did not attend ANC (Unadjusted RR=1.3, 95% CI: 0.5- 3.4) in a prospective cohort study in Eastern Uganda. ANC visits four or more times allows for detection of some pregnancy complications and risk factors for PNM such as PIH, abnormal presentation, intra-uterine growth restriction which usually appear later in pregnancy. Antenatal screening and identification of risk factors, with concomitant effective and timely intervention prevents PNM (Behal & Vinayak, 2015)

APH and PNM: This study found mothers not referred on account of APH to have 91% reduced odds of PNM compared to those with APH. Other studies had similar findings. A case-control study in Ethiopia found APH to be an independent predictor of PNM (AOR, 12.2; 95% CI, 4.70-31.71) (Bayou & Berhan, 2009). Yirgu et al. (2016) also found APH to increase the odds of PNM (AOR = 9.55, 95% CI 4.67–19.54). The main causes of APH are abruptio placentae and placenta previa. APH is known to contribute significantly to PNM (Takai & Sayyadi, 2017). There is a five-fold increase in risk of PNM in women with APH compared to those without it (Behal & Vinayak, 2015). APH reduces blood and oxygen supply to the fetus, thus causing fetal hypoxia, intra-uterine fetal death (IUD), stillbirth and birth asphyxia. It also causes preterm delivery with its concomitant increase in risk of PNM. Maternal complications

resulting from hypovolemic shock, disseminated intravascular coagulation, and acute renal failure also increase risk of IUD, birth asphyxia, still birth and early neonatal death (Takai & Sayyadi, 2017).

Accompanied by HW and PNM: This study found being accompanied by a HW on referral to increase risk of PNM. This contrasts with knowledge on the benefits of being accompanied by a HW in emergency referrals. Being accompanied by a HW allows for provision of continuum of care till the receiving facility is reached (Afari, 2015). The provision of continuous care aides in preventing adverse outcomes. A plausible explanation to the finding from this study is that, HWs tend to accompany cases with bad prognosis. As such, although they accompany such patients, and may provide continuous care, the outcome still remains negative.

5.5 Strengths and Limitations

This study can be considered to be the first of its kind that had been carried out in the Greater Accra Region on factors associated with PNM among referred obstetric emergencies, particularly with regards to influence of referral system factors on perinatal mortality. Its employment of multiple means of verification of information obtained from respondents improved the accuracy of measurements, particularly with respect to the time measures, referral diagnosis and perinatal outcomes. The employment of respondent answers helped circumvent inadequate documentation challenges faced in the four hospitals.

Nonetheless, the cross-sectional study design limits causal inference. A major limitation with this study, just as with other hospital-based studies, was referral bias, although collection of medical information is easier in the hospital. The study excluded risk factors of PNM such as multiple pregnancy, maternal smoking and alcohol intake and fetal malformations because it considered the risk factors assessed in this study to be major, and relevant under emergency

conditions. Also, the four facilities selected for the study as well as the snapshot view provided by this study over the study period of April to July, 2017 could not also be said to be representative. Generalization therefore from the sample is constrained.

In conclusion, this chapter discussed the findings of the study in relation to existing literature. The next chapter presents the summary, conclusion and recommendations.



CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

This chapter provides a summary of the study, and proceeds to make recommendations based on findings from the study. It entails clinical and non-clinical reasons for referrals, adherence to referral guidelines, prevalence of PNM among referred obstetric emergencies, and factors associated with PNM among the referred emergencies.

6.1 Conclusion

The main clinical indication for referrals was pregnancy induced hypertension (pre-eclampsia and eclampsia). Few referrals were due to non-clinical reasons. Non-availability of a doctor/midwife was the main non-clinical reason for referrals. Adherence to referral guidelines was poor. Prevalence of PNM among the referred emergencies was comparatively high. Factors found to be independent predictors of PNM among the referred clients include accompanied by health worker, ANC visits and APH. Not accompanied by a HW, attending ANC four or more times and not referred due to APH reduced the odds of PNM.

6.2 Recommendations

Recommendation for policy

The Ministry of Health needs to review and update the referral policy and guidelines, taking into account current challenges with the system and ways of enforcing the guidelines.

Recommendations for clinical practice

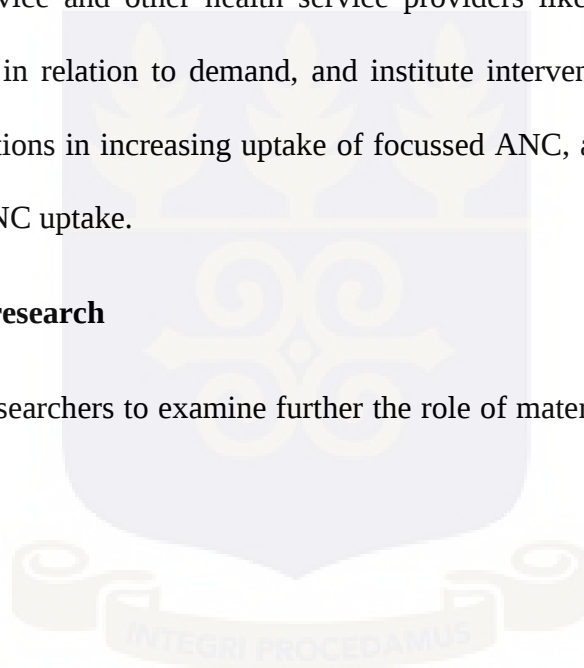
Clinicians must attend quickly and have a low thresh-hold for lifesaving interventions for referred emergencies with APH, accompanied by a HW and with poor ANC attendance record. Care for this group of persons should be prioritized.

Referring clinicians should endeavour to refer such clients early and quickly to reduce high exit times noted in this study. The receiving facility should also be contacted ahead of patient transfer.

The Ghana Health Service and other health service providers like CHAG should review hospital bed capacities in relation to demand, and institute interventions. There is need to review current interventions in increasing uptake of focussed ANC, and also find innovative measures to increase ANC uptake.

Recommendation for research

There is the need for researchers to examine further the role of maternity referral systems on perinatal health.



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APPENDICES

APPENDIX A: Structured Questionnaire

TITLE: PREGNANCY OUTCOMES AMONG INTRA-PARTUM OBSTETRIC
EMERGENCY REFERRALS TO THE RIDGE REGIONAL HOSPITAL, ACCRA

Patient ID: Telephone No. (if available/ willing):

Referring facility:

Socio-demographic factors:

- Patient ID: Tel No
- Age
- Occupation:
- Educational Status: None, Primary/JHS, Secondary/ Technical , Tertiary
- Place of residence:
- Average Income per month (GHC):

Maternal factors:

- Main complaint:.....
- Parity:
- Number of ANC attendance prior to referral:..... (*verify)
- Place of ANC attendance:
- Gestational age on referral: weeks (*verify)
- History of Perinatal mortality: Yes/ No
- Mode of Delivery: SVD/ Assisted vaginal delivery/ C.S.
- Referral Diagnosis:(*verify)

Fetal factors

- Sex of Baby: Male/ Female (*verify)
- Birth weight of Baby:kg (*verify)
- Gestational age at birth: Weeks (*verify)

Referral factors

- Mode of Transportation:
- It was easy obtaining transport on referral : Yes/ No
- Nature of road: Good/ Bad
- Interfacility communication: Yes/ No (*verify)
- Accompanied by Health worker: Yes/ No
- Number of prior health facilities attended from first referral:
- Prior home visit: Yes/ No
- Any non-clinical reason for referral: Yes/ No
 - o If yes, state:
- Came with referral letter: Yes/ No (verify)
 - o If yes, was treatment given information stated? Yes/ No

Time factors

- Exit time:(*verify)
- Transport time:
- Waiting time:(*verify)
- Decision-to-delivery time (for emergency c.s. clients):(*verify)

Foetal outcome:

- IUFD on arrival: Yes/ No (*verify)
- Still birth : Yes/ No (*verify)
 - o If Yes; Macerated or Fresh
- Condition of baby on delivery (birth asphyxia): Yes/ No (*verify)

- Admission to NICU: Yes/ No
 - If yes: reason for admission:(* verify)
- Birth outcome on day 7 of birth: well, early neonatal death, other:

* data will be verified using multiple verification sources: referral slips, clinician/ relative interview, review of medical records.



APPENDIX B: Consent information

DEPARTMENT OF EPIDEMIOLOGY

SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF GHANA, LEGON

CONSENT INFORMATION

PURPOSE OF RESEARCH

Greetings, my name is and I am conducting this interview on behalf of Dr. Paul Boateng, a Master of Philosophy Applied Epidemiology and Disease Control resident of the School of Public Health, University of Ghana. The research also is in partial fulfilment of the requirements for the award of the above-mentioned Master of Philosophy degree.

When a woman dies as a result of pregnancy or its complications, it is termed maternal death/maternal mortality. When a woman loses her baby after 28 weeks of pregnancy or within one week of delivery, it is termed perinatal mortality. A referral is when a patient is asked to seek care at another health facility. Patients are referred due to several reasons such as

Maternal deaths are unacceptably high globally. More of these maternal deaths occur in Sub-Saharan Africa, which includes Ghana. Perinatal mortality is also high in this part of the world. Having an effective referral system is key in reducing maternal and perinatal mortality. Indeed, significant reductions in maternal and perinatal mortality cannot be achieved without ensuring effective referral systems.

This study thus seeks to assess delays within the obstetric emergency referral system. It will seek to provide information on the reasons for referrals, gaps within the referral system, pregnancy outcomes among referred clients as well as factors associated with referral outcomes.

It will add knowledge to the already existing published literature on obstetric referral systems. Finally, it will help to develop strategies in bridging the referral gaps, and ultimately reducing maternal and perinatal mortality.

You are being invited to participate in the study because were referred here from another facility as an emergency around the time of labour and also because you were retained in our sample. If you agree to participate, you will be among 422 mothers who will also be participating in the study in this hospital. This study will be undertaken over a 3 month period.

VOLUNTARY PARTICIPATION

Your participation in this study is entirely voluntary. Your decision not to participate will not have any negative effect on you or on your relation. In the course of the study you can redraw anytime you want to, without any consequences.

DURATION OF STUDY INVOLVEMENT

This research study is expected to take approximately 2 months to interact with selected participants and to gather necessary information. Responses will be put together and analyzed in the next month. Final report should be complete by the end of July, 2017.

PROCEDURES

If you choose to participate, the research assistant will explain all the procedures to be followed in a language you understand. You will be given the opportunity to ask all questions you may have and further explanations will be given.

Signing or Thumb printing of Questionnaire:

If you agree to participate, you will be requested to sign a consent form or thumb print if you wish to indicate that you fully agree to part. This will be done after understanding the purpose of study and agreeing to be part of study.

Administration of Questionnaire:

A set of questions will be asked by the research assistant for which you will be requested to provide genuine answers as much as possible. Some of the questions include what health facility were you referred from, why were you referred, what was your means of transportation to Ridge Hospital among others. You can however decide not to answer questions you feel uncomfortable with. Each questionnaire will take less than 20 minutes to complete and it will be a one-time questioning period.

Review of Health Records:

I would like to also look into your referral slip and your medical folder to verify as well as record some information within it such as referral diagnosis among others. However, if you do not have one or it cannot be found, I would just note accordingly.

Risks:

There are no major risks attached to responding to the questionnaires. You however may feel emotional or feel distraught by some questions. When we realize this or when you draw our attention to this, we may discontinue that line of questioning or stop the interview altogether. We would provide psychological support when appropriate and with your consent. Your

identity will not be disclosed whatsoever in this study, however for purposes of data analysis each form will be coded.

PARTICIPANT RESPONSIBILITIES

As a participant, your responsibilities include:

- Follow the instructions of the research assistant
- Complete your questionnaires as instructed
- Ask questions as you think of them
- Tell the research assistant if you change your mind about staying in the study
- Making available your medical records

WITHDRAWAL FROM STUDY

If you first agree to participate and later change your mind, you are free to withdraw your consent and discontinue your participation in the study. Your decision will not affect your ability or your relation's ability to receive medical care and you will not lose any benefits to which you would otherwise be entitled.

POSSIBLE RISKS, DISCOMFORTS, AND INCONVENIENCES

Even though there are no risks linked to participating in this study, we will be asking questions bothering your personal life including loss of a baby or loss of a loved one. These may generate some discomfort and inconveniences. These deserve careful thought. You should talk with the

research assistant if you have any such discomforts and ask questions whenever you want clarification.

POTENTIAL BENEFITS

We cannot and do not guarantee or promise that you will receive any benefits from this study. We however hope that the outcome of this study would be used to advice on policies that bother on women's health especially strategies that seek to address gaps and challenges in the maternity referral system.

PARTICIPANT'S RIGHTS

You should not feel obligated to agree to participate. Your questions should be answered clearly and to your satisfaction. If you decide not to participate, tell the research officer.

CONFIDENTIALITY

The results of this study may be presented at scientific or medical meetings or published in scientific journals. Your identity and/or your personal information or that of your relation will not be disclosed except as authorized by you or as required by law. No response given will be disclosed to any unauthorized persons. Neither your name nor any identity traceable to you or your relation will be indicated on the survey forms.

CONTACT INFORMATION

Questions, Concerns, or Complaints: If you have any questions, concerns or complaints about this research study, its procedures or risks and benefits, you should ask the research assistant.

Independent Contact: If you are not satisfied with how this study is being conducted, or your questions/ concerns etc. are not satisfactorily answered by the research assistant or if you have further concerns, complaints, or general questions about the research or your rights as a participant, please contact:

Dr Anthony Danso-Appiah (Supervisor)

School of Public Health

University of Ghana, Legon

Tel: 0236133565

e-mail: tdappiah@yahoo.co.uk

Or

Paul Boateng (Principal Investigator)

School of Public Health

University of Ghana, Legon

Tel: 0242748336

Email: pauliboat2@gmail.com

Or

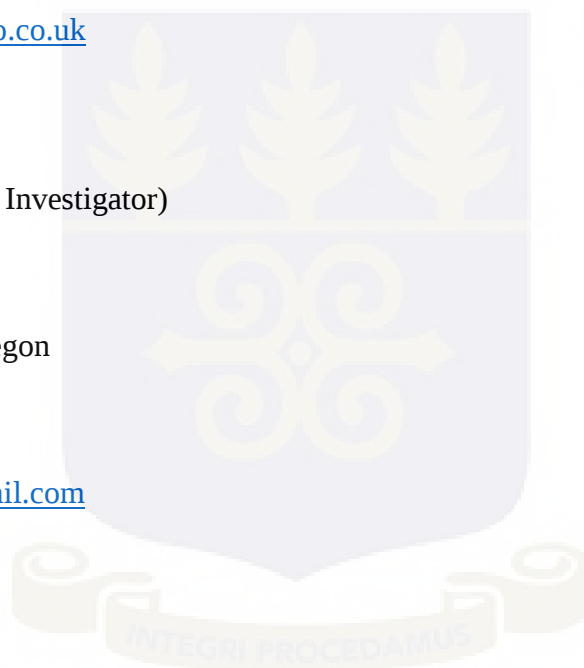
Hannah Frimpong

Administrative Secretary

Ghana Health Service Ethical Review Committee

Tel: Tel 0507041223

Email: ghserc@gmail.com



Statement of Consent

I have read this consent form or it has been read and explained to me. I have had the opportunity to discuss this research study with and/ or his/her study staff. I have had my questions answered by them in a language I understand. The risks and benefits have been explained to me. I believe that I have not been unduly influenced by any study team member to participate in the research study by any statement or implied statements. I understand that my participation in this study is voluntary and that I may choose to withdraw at any time. I freely agree to participate in this research study.

I understand that information regarding my personal identity/ that of my relation will be kept confidential.

By signing this consent form, I have not waived any of the legal rights that I have as a participant in a research study.

Participant signature/Thumb print_____

Date _____

(Day / month / year)

