ASSESSMENT OF THE PROVISION OF EMERGENCY OBSTETRIC CARE SERVICES IN RACHUONYO NORTH SUB-COUNTY, HOMA BAY COUNTY, KENYA

BY

CHERUIYOT ANDREW KIPYEGON

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH (HEALTH SYSTEMS MANAGEMENT)

SCHOOL OF PUBLIC HEALTH AND COMMUNITY DEVELOPMENT (ESPUDEC)

MASENO UNIVERSITY

DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

No part of this thesis may be reproduced without the prior written permission of Maseno University.

Sign: _____ Date:_____

Cheruiyot Andrew Kipyegon

PG/MPH/06020/2012

SUPERVISORS

This thesis has been submitted for examination with our approval as university supervisors.

Sign: _____ Date: _____

Prof. Collins Ouma, (PhD)
School of Public Health and Community Development,
Maseno University

Sign: _____ Date: _____

Dr. Harrysone Atieli, (PhD)
School of Public Health and Community Development,
Maseno University

ACKNOWLEDGEMENT

I extend my sincere gratitude to God Almighty for giving me energy to complete this thesis.

I would also like to give appreciation to my research supervisors Prof. Collins Ouma and Dr. Harrysone Atieli for their support during development of this thesis. Special thanks go to my loving wife Rachel C. Cheruiyot and my daughter Natasha Cherop for allowing me to pursue my education the time I should be spending with them. I wish to extend further gratitude to my classmates of Maseno MPH Homabay campus for the critique they offered during development of this thesis and their continued support.

Lastly, I would like to thank the entire Maseno University fraternity for giving me a chance to pursue my further education in their institution.

DEDICATION

This work is dedicated to my late father Richard Ng’asura for his dedication to educate us.

ABSTRACT

Emergency obstetric care (EmOC) is a package of medical interventions required to manage the major direct obstetric complications. Provision of EmOC services averts direct maternal mortalities from these complications. Maternal mortality ratio (MMR) still remains high worldwide. Global MMR is estimated to be 251 per 100,000 live births; Sub-Saharan Africa has the highest MMR in the world at 900 per 100,000 live births. Whereas Kenya and Homa Bay County has MMR of 362 and 583 per 100,000 live births, Rachuonyo North Sub-County in Homa Bay County, has limited information on MMR. Documentation on the status of EmOC services in the Sub-County remains unknown. Aim of the study was to assess the provision of EmOC services in Rachuonyo North Sub-County, Homa Bay County, Kenya. The specific objectives were; to assess the availability of EmOC services, to determine the utilization of EmOC services and to determine the quality of EmOC services in Rachuonyo North Sub-County. The study was a health-facility based cross-sectional study. All 30 health facilities offering maternity services were surveyed. Data collection tools as outlined in WHO standard guidelines for monitoring EmOC were applied. Availability was measured by interviewing service providers on performance of signal functions at least once in the previous 3 months. Proportions of EmOC facilities in relation to population were obtained. Utilization was determined by inspecting facility registers to extract records on use of EmOC services. Differences in utilization between basic and comprehensive EmOC facilities were compared using chi-square at 95% confidence interval. Furthermore, quality was determined by obtaining direct obstetric case fatality rate, intra-partum and very early neonatal death rate. Results showed that 2 health facilities offered EmOC services in a population of 177,587. The WHO recommendation on availability of 5 EmOC facilities per population of 500000 was met. Utilization of EmOC facilities by women with obstetric complications was low at 6.2% in comparison to the WHO recommendation that 100% of women with obstetric complications be treated in EmOC facilities. In addition, there was no difference between utilization of services in basic and comprehensive EmOC facilities ($p>0.05$). Caesarean section rate of 2% in the Sub-County was lower than recommended of 5-15%. The quality of EmOC services was low due to lack of referral system and inadequate human resource in the basic EmOC facility. There was no direct obstetric fatality in EmOC facilities. This was equivalent to recommendation of ≤1%, while the figure was higher in all surveyed facilities at 6.25%. The intra-partum death rate was found to be 1.98% in EmOC facilities. The MMR was estimated at 90 per 100000 live births. In conclusion, EmOC services are available in Rachuonyo Sub-County with low utilization. Furthermore, there was low quality of EmOC services in basic EmOC facility. Recommendations include increasing resources to facilities in the Sub-County, educating women to utilize EmOC services, have a system to continually monitor quality of services offered in the facilities. Results would improve knowledge-base on availability, utilization and quality of EmOC services in order to develop interventions for managing obstetric complications.

TABLE OF CONTENTS

LIST OF ABREVIATIONS

ANC	Antenatal care
APH	Ante partum hemorrhage
C/S	Caesarian section
DMOH	District Medical Officer of Health
EmOC	Emergency Obstetric Care
HMIS	Health Management Information System
KDHS	Kenya Demographic Health Survey
MDG	Millennium Development Goals
MMR	Maternal Mortality Ratio
MMS	Ministry of Medical Services
MOPHS	Ministry of Public Health and Sanitation
PPH	Post-partum hemorrhage
UN	United Nations
UNICEF	United Nations International Children Education Fund
WHO	World Health Organization

OPERATIONAL DEFINITIONS

Availability of Emergency obstetric care services (EmOC) - Is measured by the ability of a health facility to perform the complete set of signal functions and also the number of facilities that perform the complete set of signal functions in relation to the size of the population.

Direct causes of maternal death – These are deaths resulting from obstetric complications of pregnant state; from interventions, omissions, or incorrect treatment; or a chain of events resulting from the above.

Direct obstetric case fatality rate- Proportion of women admitted with major direct obstetric complications, or who develop such complications after admission, and die before discharge.

Early neonatal deaths- Neonates born at term who could not be resuscitated (or for whom resuscitation was not available) or who had a specific birth trauma. The death must have occurred within 24 hours of delivery.

Indirect causes of maternal deaths – Deaths resulting from previous existing disease or disease that developed during pregnancy and that was not due to obstetric causes but that was aggravated by the physiological effects of pregnancy.

Maternal death - WHO definition, "The death of a woman while pregnant or within 42days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by pregnancy or its management but excluding accidental or incidental causes."

'Met need' – Is an estimate of the proportion of all women with major direct obstetric complications who are treated in a health facility providing EmOC.

‘**Minus one’**- A signal function can be systematically absent in a country due to national policies or pre-service training then it is possible to use the designation ‘comprehensive minus 1’ or ‘basic minus 1’. This is used as a temporary measure, while policies are reviewed.

Obstetric emergencies- Are life threatening medical conditions that occur in pregnancy or during or after labor and delivery.

Provision of EmOC services – Act of rendering obstetric care services to pregnant mothers when they need.

Quality of EmOC – Involve a state of readiness that will enable EmOC staff to respond appropriately to obstetric emergencies in a way that fulfils the needs and rights of clients, it is also measured by obtaining direct obstetric case fatality rate, intra partum and very early neonatal death rate and proportion of maternal deaths due to indirect causes.

Severe maternal morbidity (Near miss) - Is defined as: “any pregnant or recently delivered woman (within six weeks after termination of pregnancy or delivery), in whom immediate survival is threatened and who survive by chance or because of the hospital care she receives.”

Signal functions - Are key medical interventions that are used to treat the direct obstetric complications that cause vast majority of maternal deaths around the globe. List of signal functions include administration parental antibiotics, uterotonic drugs, anticonvulsants, manual removal the placenta, removal of retained products, perform assisted vaginal delivery, neonatal resuscitation, caesarean section, and blood transfusion.

Stillbirths - Infants born dead after more than 28weeks of gestation without signs of skin disintegration or maceration; the death is assumed to have occurred less than 12hours before delivery.

Utilization of EmOC - Proportion of all births in EmOC facilities and proportion of all women with major direct obstetric complications who are treated in a health facility providing EmOC.

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

Emergency obstetric care (EmOC) consists of signal functions that include administration of parenteral antibiotics, uterotonic drugs, parenteral anticonvulsants, manual removal of placenta, removal of retained products of conception, assisted vaginal delivery by application of vacuum, neonatal resuscitation, blood transfusion and caesarian section (WHO and UNICEF, 2009). These interventions help in reducing maternal mortalities as a result of direct obstetric complications (Ameh *et al*., 2012). Global maternal mortality ratio(MMR) decreased from 422 in 1980 to 320 in 1990, and was 251 per 100,000 live births in 2008 (Hogan *et al*., 2008). Despite decline in MMR worldwide, the target anticipated in the Sustainable Development Goal (MDG) 3 remains elusive. Developing countries has high maternal mortality with Sub-Saharan Africa having the highest burden of maternal mortality. MMR in Sub-Saharan Africa was estimated to be 900 per 100,000 live births (Fournier *et al*., 2009). In Kenya, maternal mortality remains a major public health problem with MMR at 362 per 100,000 live births (KDHS, 2014) a decrease from 488 per 100,000 live births in 2008-09 (KDHS, 2010) the difference is not large enough to conclude whether or not there has been any change over time between the two surveys. Homa Bay County has MMR of 583 per 100,000 live births (UNFPA, 2015b), Rachuonyo North Sub-County, Homa Bay County has been deficient on information pertaining to maternal mortality.

Maternal deaths, to a large extent, are due to delayed or substandard EmOC (Ziraba *et al*., 2009). Developing interventions to improve management of obstetric complications is needed (Dumont, 2012). Many health facilities in Tanzania that were assumed to be fully functioning in fact were not because of many challenges including staff shortage, unreliability of obtaining drugs and

medical supplies and staff training deficiency (Mkoka *et al*., 2014). In Western Africa, maternal mortality was found to be highest in rural areas where access to EmOC was limited by geographical distance to health facilities and scarce resources (Fournier *et al*., 2009). In Kenya, national study of availability of EmOC is lacking. A study done in Malindi, Kenya revealed that there was no uniform performance of signal functions with administration of parenteral antibiotics and anticonvulsants being least performed while administration of uterotonic drugs and manual removal of placenta were most performed (Echoka *et al*., 2013). Availability of EmOC services at Rachuonyo North Sub-County in Homa Bay County had not been quantified, therefore data on performance of signal functions in relation to population was lacking.

Women delivering in health facilities in Kenya remain low at 43%. Also the unmet need for reproductive health services like contraceptives translate to unacceptably high MMR (KDHS, 2010). Targets by many governments are to have 100% of women receiving skilled care during delivery. Kenyan government has improved access to maternity services by abolishing user fees in government facilities and also improving communication and road network. Utilization of EmOC services in Rachuonyo North Sub-County in Homa Bay County had not been documented.

Measure of quality of EmOC services has been a source of controversy. Few studies have explored the quality of EmOC services offered by health facilities (Ziraba *et al*., 2009). Focus has been on mortality as an indicator of quality, but morbidity and prolonged length of hospital stay as a result of poor clinical management has not been featured. Level of preparedness in the facility to provide EmOC service can also be used in assessing quality. Timely and appropriate

response to clients' needs is important in quality improvement. The quality of EmOC services at Rachuonyo Sub-County had not been documented.

1.2 PROBLEM STATEMENT

Even though the government of Kenya has introduced free maternity services in all public health facilities, there was limited research on provision of EmOC services at the health facilities. Little was known on the availability of EmOC services in Rachuonyo North Sub-County. In addition, the reasons why the services were not provided in the health facilities had not been documented. Although there was an increase in health facility deliveries in Rachuonyo North Sub-County, no documentation exists on whether women with obstetric complications were using these facilities. The type of women utilizing EmOC services in Rachuonyo North Sub-County had not been explored.

Existing information on quality of obstetric care was lacking on existence of quality improvement processes in the hospital based on readiness of the facility to provide EmOC, staff response to obstetric emergencies and also provision of services that correspond to rights and needs of clients. Little was known on the categorization of causes of maternal deaths into direct and indirect maternal deaths in Rachuonyo North Sub-County. This information is crucial in finding out extent of preventable maternal deaths.

1.3 OBJECTIVES

1.3.1 BROAD OBJECTIVE

To assess the provision of emergency obstetric care services and maternal mortality ratio in Rachuonyo North Sub-County, Homa Bay County, Kenya

1.3.2 SPECIFIC OBJECTIVES

i. To assess the availability of EmOC services in Rachuonyo North Sub-County, Homa Bay County, Kenya

ii. To determine the utilization of EmOC services in Rachuonyo North Sub-County, Homa Bay County, Kenya

iii. To determine the quality of emergency obstetric care services in Rachuonyo North Sub-County, Homa Bay County, Kenya

1.3.3 RESEARCH QUESTIONS

i. What are the availability of EmOC services in Rachuonyo North Sub-County, Homa Bay County, Kenya?

ii. What are the utilization of EmOC services offered in Rachuonyo North Sub-County, Homa Bay County, Kenya?

iii. What are the qualities of emergency obstetric care services in Rachuonyo North Sub-County, Homa Bay County, Kenya?

1.4 SIGNIFICANCE OF THE STUDY

Maternal mortality poses a great burden to the family and community. Availability and utilization of quality EmOC services leads to reduction in maternal mortality ratio. This study aimed at investigating the availability, utilization and quality of EmOC services in order to reduce obstetric mortality and morbidity in the study area.

The results from the study would be utilized at different levels to improve services. At national level, it would be used in budgetary allocations to health in increasing availability of maternal services through upgrading of existing facilities. Close attention to the functioning of key services and programs can substantially and rapidly reduce maternal mortality in developing countries. At the County level, it would help to improve basic and in-service training for health providers in order to improve their skills in both clinical and service management. Use of these EmOC indicators to assess needs can help program planners in the County to identify priorities and interventions e.g. equipment inventory. At the Rachuonyo North Sub-County level, it would improve knowledge base on availability, utilization and quality of EmOC services in order to develop interventions for managing obstetric complications.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter literature was reviewed on the existing information related to availability, utilization and quality of EmOC services. Knowledge gaps were identified after comparing and contrasting the available information and critiquing the same. The sub-topics discussed corresponded to the specific objectives.

2.2 AVAILABILITY OF EMERGENCY OBSTETRIC CARE SERVICES

The number of facilities that perform set of signal functions in relation to the size of the population is a measure of availability of EmOC services. A fully functioning basic facility is one that staff has performed all the seven signal functions of basic EmOC in the 3-month period before the assessment. The facility is classified as comprehensive when staff has carried out all seven signal functions plus surgery and blood transfusion. Minimum acceptable level for every population of 500,000 is five EmOC facilities, at least one of which provides comprehensive care (WHO and UNICEF, 2009).

In a previous study, investigators found out that many facilities that were assumed to be fully functioning in fact were not, either due to staff training deficiency, staff shortage, lack of equipments, drug shortage or poor management. It has been found that no country has the recommended ratio of basic EmOC to population, although several countries have a ratio of comprehensive plus basic facilities to population that is close to or equal to 5 EmOC facilities to population of 500,000 (Paxton *et al*., 2005). A study done in Nigeria showed EmOC services were more available in private facilities than public facilities. Of the 258 health facilities studied, 2.5% met the UN guidelines to be designated as a basic emergency obstetric care facility, and 28

facilities (10.9%) met the standard for a comprehensive emergency obstetric care facility (Saidu *et al*., 2013). A previous study carried out a cross-sectional analyses in Nigeria region and reported that only 6(10.2%) of the 59 facilities studied in that state met the UN requirements of EmOC centres (Abegunde *et al*., 2015). Another study found out that 5 of the 40 facilities assessed in Malindi, Kenya, qualified as EmOC "minus one" that is perform all nine signal functions except assisted vaginal delivery (Echoka *et al*., 2013).

A systematic review of multiple databases of peer reviewed journals reported that although some studies showed signal function performance in 3 months, others reported conduct within a 6 month period as this was more applicable in areas with low facility deliveries. It was also noted that there was need to capture signal function performance band in 3 indices critical to its conduct; drugs, equipment and personnel. Furthermore, the review reported on the challenges in assessing the availability of EmOC services. The challenges highlighted included: assessing availability in population less than 500,000 as stipulated by WHO which was remediated by number of facilities per 125,000; secondly, although population of 500,000 provides a sufficient basis for comparison of EmOC availability, it does not reflect the actual need for the population; thirdly, there exists confounding factors for availability such as population density, availability of human resource, and 24 hours a day/7days a week service provision which makes it necessary to be considered in reporting this indicator (Banke-Thomas *et al*., 2016)**.**

A cross-sectional study carried out in Kenya and other five countries in Sub-Saharan Africa and India showed that availability of EOC was below minimum. Coverage of basic EmOc services ranged from 0.1-1/500,000 population, whereas, comprehensive EmOC coverage ranged from

0.5-4.3/500,000 population (Ameh *et al*., 2012). Availability of EmOC services at Rachuonyo North Sub-County in Homa Bay County had not been quantified; therefore data on performance of signal functions in relation to population remained unknown. The aim of the study was to investigate the availability of EmOC services in Rachuonyo Sub-County, Homa Bay County, Kenya.

2.3 UTILIZATION OF EMERGENCY OBSTETRIC CARE SERVICES

Utilization of facilities with EmOC services is measured by the proportion of all births in an area that takes place in EmOC health facilities (basic or comprehensive). The numerator is the number of women registered as having given birth in facilities classified as EmOC facilities. The denominator is an estimate of all the births expected in the area, regardless of where the birth takes place. The expected number of all live births is usually calculated by multiplying the total population of the area by crude birth rate of the same area. No minimum level has been set, many governments have committed themselves to increasing the proportion of women who give birth in health facilities, some aiming at 100% (WHO and UNICEF, 2009).

Another measure of utilization is the proportion of all women with direct obstetric complications who are treated in a facility providing EmOC services (basic or comprehensive). The numerator is the number of women treated for direct obstetric complications at emergency care facilities over a defined period, divided by the expected number of who would have major obstetric complications, or 15% of expected births, during the same period in a specified area. Direct obstetric complications include post- and ante partum hemorrhage, obstructed labor, sepsis, complications of abortion, hypertensive disease of pregnancy (WHO and UNICEF, 2009). It is

expected that all women with obstetric complications receive EmOC services; therefore, the minimum acceptable level is 100% (WHO and UNICEF, 2009).

Health-facility based study found out that 26.2% of estimated annual births took place in EmOC facilities against the required minimum of 15% (Biswas *et al*., 2005). A study carried out in Sierra Leone revealed that women with obstetric complications will seek hospital care if services are available (Leigh *et al*., 1997). Utilization of EmOC facilities was found to be sub-optimal in a cross-sectional study done in Nigeria (Abegunde *et al*., 2015). The reported figure was worse in Ethiopia as evidenced by a different study in which data showed that only 6% of women with obstetric complications were treated in health facility, half of whom were treated in a fully functioning EmOC facility (Admasi *et al*., 2011).The reasons why women with complications do not use health facilities are varied. Inadequate basic information about obstetric complications cost of services, poor roads, and previous experiences at the health facility are some of the factors. The author further noted that government hospital services can be improved by building on existing resources (Leigh *et al*., 1997). Survey of health facilities both private and public found out that there was poor utilization of EmOC services by women in Nigeria, 13.6% of deliveries took place in EmOC facilities. The study also revealed that caesarian section rate was 2.3% which was below acceptable level in Nigeria state (Saidu *et al*., 2013). In Kenya, existing data shows that 43% of pregnant women deliver in health facilities. These facilities are not known to provide EmOC services (KDHS, 2010). Although utilization of EmOC services in Rachuonyo North Sub-County had not been documented, existing evidence from other parts of the country shows sub-optimal use of these services (Ziraba *et al*., 2009). The current study aimed to establish the level of utilization of these services at Rachuonyo Sub-County.

2.4 QUALITY OF EMERGENCY OBSTETRIC CARE SERVICES

Adequacy of quality of emergency obstetric care services is measured by finding out the level of preparedness in the facility to provide timely and appropriate response to clients' needs. Quality is also measured by obtaining direct obstetric case fatality rate, intra partum and early neonatal death rate and proportions of maternal deaths due to indirect causes relatively crude indicators of quality. Minimum level of direct obstetric case fatality rate at <1% (WHO and UNICEF, 2009).

Quality of obstetric care in public sector facilities was explored in a previous study by Anwar et al 2009. In their study, they found out that human resource constraints were the major barriers for maternal health these include understaffing of rural facilities and difficulties retaining trained human resource. Other challenges included unavailability of blood in rural settings and lack of use of evidence-based technique (Anwar *et al*., 2009). Other approaches have proposed to assess quality of care provided at facilities, which include collecting data on the interval between the time a woman is admitted to an EmOC facility and the time she actually receives treatment. Detailed case reviews or audits of both maternal deaths and 'near misses' can also provide valuable information about quality of care (WHO and UNICEF, 2009). One audit process revealed that provision of appropriate care was delayed in 34% of cases. Delay was found to occur at three levels; delay in initiating adequate treatment despite the fact that the women had already reached a health facility occurred in 59%; in 43% of cases, delay occurred in seeking care; while in only 13% of cases, delay was caused by difficulty in obtaining access to health services. In this audit, delays were mainly due to lack of timely use of Magnesium Sulphate for pre-eclampsia, management of pre-eclampsia and hypertension, adherence to antenatal care guidelines, management of obstetric hemorrhage or use of prophylaxis for post-partum

hemorrhage (Cecatti *et al*., 2007; MOPHS and MMS, 2012; Pacagnella *et al*., 2012). Addressing the health system problems and client-related factors affecting quality of care improves maternal health in health facilities.

The complexity of assessing quality was captured in another cross-sectional in which it was observed that there were several dichotomous elements to consider in maternity care that complicates the operationalization of quality assessments; two recipients (mother and child), to aspects of care (medical and nonmedical) and two modes of care (routine and emergency). Advocated acknowledgement of these elements and holistic approach in quality assessment needs to be adopted (Nesbitt *et al*., 2013).

A survey done in maternity health facilities within or near two slums of Nairobi showed that quality of EOC services was poor. The study showed existence of deficiency in supervision, regulation and lack of basic equipment and supplies (Ziraba *et al*., 2009). The quality of EmOC services at Rachuonyo Sub-County remains undocumented. As such, the current study endeavored to determine the quality of EmOC services offered at Rachuonyo Sub-County, Homa Bay County.

2.5 CONCEPTUAL FRAMEWORK

Health care system must have facilities that are equiped and adequately staffed in order to provide EmOC services. Availability of EmOC services depend on presence of drugs, health care providers and facilities in order to perform all the signal functions. A fully functional facility is one that has the existing EmOC being used by the deserving population. Provision of quality services ultimately reduces preventable maternal mortalities. From the foregoing literature review, the conceptual framework was represented diagrammatically as shown below in figure 1:

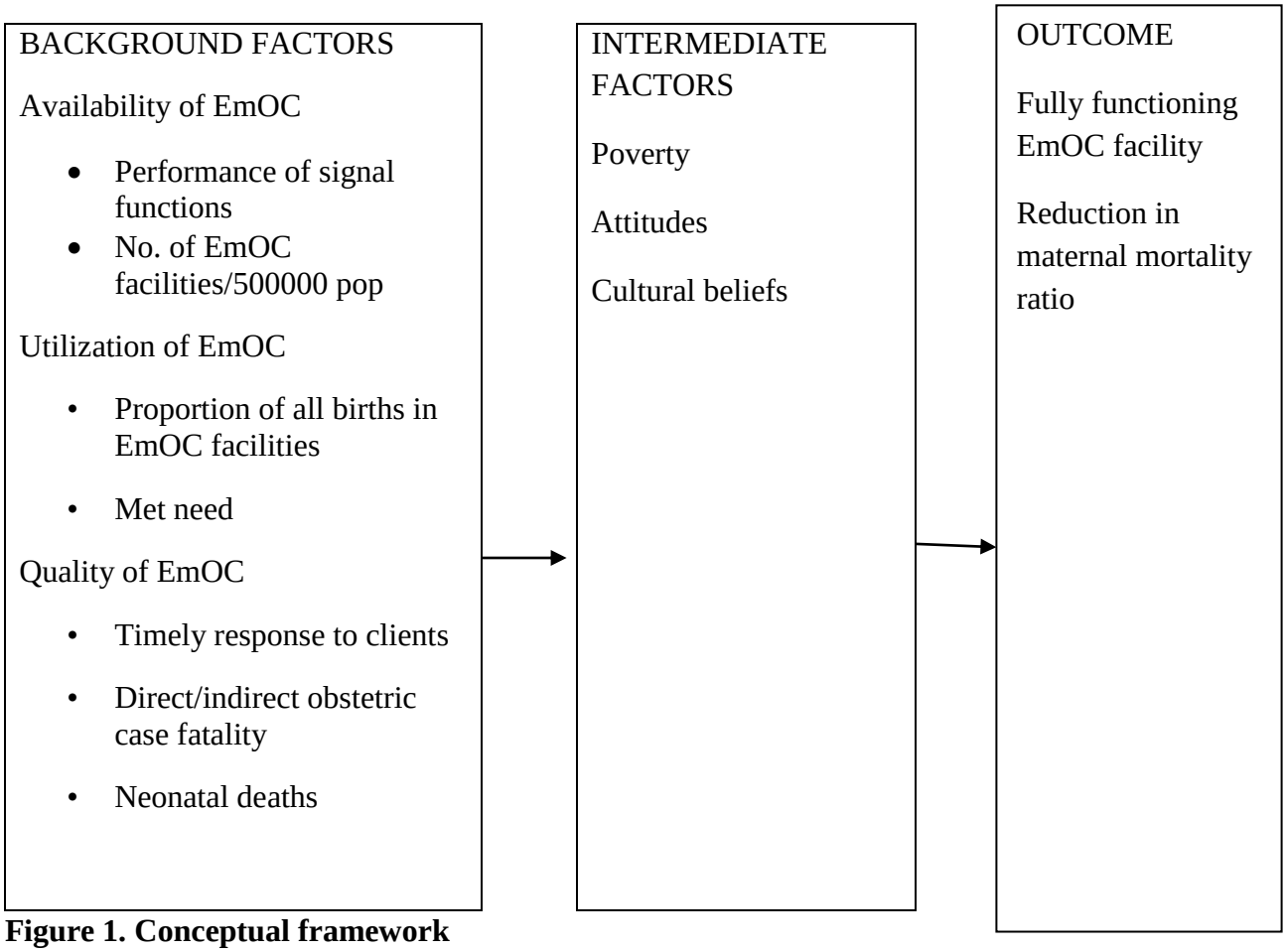


Figure 1. Conceptual framework

CHAPTER THREE: METHODOLOGY

3.1 INTRODUCTION

This chapter outlined the research methodology used in the study. Description of study site, study design, target population, method of data collection and analysis. Relevant approvals were also sort in the ethical considerations before study was commenced.

3.2 STUDY SITE

The study site was Rachuonyo North Sub-County, an administrative zone in Homa Bay County, western region of Kenya (see Appendix I). The population of Rachuonyo North Sub-County according to National population census of 2009 was 177,587(KNBS 2009). The sub-County experienced declining growth rate in its population attributed to increase in acceptability of family planning methods, the HIV and AIDs pandemic, high infant mortality and migration from sub-County to other areas due to high incidence of poverty. The average population density was 367 persons per square km. it covers a land mass area of 441.2km^2 with no water mass area.

The Sub-County has high poverty levels and about 56% of the population lives below poverty line. It manifests itself in many ways including inaccessibility to health services, high level of unemployment and under employment. The road network was poor and roads connecting rural and urban areas are not tarmacked. Literacy level was low and may have contributed to the existing general knowledge of women on maternal health service utilization. The numbers of households were 35536 as per DMOH data. Available information was deficient on the existing gender of household heads.

There were 30 health facilities comprising of one mission hospital, two sub-County hospitals, 7 health centers, and 20 dispensaries. These facilities are from level 2 to level 4 as outlined in the National Health Sector Strategic Plan II (MOH, 2005). The average distance from one facility to the next was 5-7km and the doctor patient ratio was low, making it difficult for people to access quality health care. The most prevalent diseases were malaria, respiratory tract infection and water borne diseases. Infant mortality rate was 87 per 1000, crude death rate was 9 per 1000, crude birth rate of 35 per 1000; total fertility rate was 4.4 children per woman and life expectancy of 47 (NCAPD and Development, 2005). Other demographic profiles of Rachuonyo North Sub-County are presented in table 1 below.

Table 1. Rachuonyo North Sub-County demographic profile

Description	Eligible population
Total population	177587
Total number of households	35536
Women of child bearing age (15-49 years)	39603
Children under one year (12months)	6216
Estimated number of deliveries	6216
Live births	6216
Estimated number of post abortion cases	1332
Estimated number of obstetric complications	1332
Caesarian sections	121

Source: (DMOH, 2014)

3.3 RESEARCH DESIGN

This was a health facility-based cross sectional study. The design had been selected to aid in describing the state of affairs as it existed at that particular point in time. Structured questionnaire was administered to collect data.

3.4 STUDY POPULATION

The study population included saturated sampling of all health facilities in Rachuonyo North Sub-County, Homa Bay County. The sub-County has 20 dispensaries, 7 health centers, 2 sub-County hospitals and 1 mission hospital. Level 2 facilities provide limited (emergency) normal delivery service while level 3 provide maternity for normal deliveries (MOH, 2006).

3.4.1 INCLUSION CRITERIA

All health facilities offering maternity services in Rachuonyo North Sub-County, Homa Bay County, Kenya were surveyed.

3.4.2 EXCLUSION CRITERIA

Health facilities not offering maternity services and those with incomplete data were not studied.

3.5 SAMPLING TECHNIQUE

The approximate distance between health facilities in Rachuonyo North Sub-County is 5km. Road network was poor for most areas but passable As such, saturated sampling technique was applied because it was feasible to study all 30 health facilities. The criterion is to study all facilities if the number of hospitals is less than 25 and the lower level facilities are fewer than 100 (WHO and UNICEF, 2009).

3.6 METHOD OF DATA COLLECTION

Tools for data collection were adopted from WHO guidelines for monitoring emergency obstetric care services (WHO and UNICEF, 2009). Data on availability of EmOC services were obtained by administering a standard tool to interview maternity in-charges (or facility in-charge in level 2 facilities) on the performance of signal functions at least once during the previous 3 months. If any of signal function had not been performed, reasons were recorded (Appendix II).
Data on utilization was measured by reviewing facility registers including maternity registers, operating theatre registers and reports in the previous one year from the day of study.

Information on quality was obtained from inspecting facility registers on maternal deaths neonatal deaths. A check list on staffing, availability of equipment, existence of quality

improvement systems, delay time and referral system was filled. The possibility of double-counting of women who were admitted to more than one facility was reduced by counting the complications on the facility at which the women receive definitive treatment. It was made easy by the indications made on maternity register on the destination of referral.

Validity and reliability of the data collection tools was ensured by applying a standard tool adopted from WHO guidelines for monitoring emergency obstetric care services (WHO and UNICEF, 2009).

3.7 RESEARCH VARIABLES

3.7.1 INDEPENDENT VARIABLES

Independent variables included indicators of EmOC service such as availability of EmOC as shown by performance of signal functions, ratio of EmOC facilities to population size; utilization of EmOC services as shown by proportion of all births in EmOC facilities and women with obstetric complications using the EmOC facilities; and quality of EmOC as shown by direct obstetric case fatality and neonatal deaths.

3.7.2 DEPENDENT VARIABLE

Dependent variables included fully functioning emergency obstetric care services and maternal mortality ratio.

3.8 DATA ANALYSIS

Data was analyzed using manual tally sheet, Microsoft Excel and Statistical Package for Social Scientists (SPSS, version 20). Descriptive statistics, including frequencies, proportions, and media were used to analyze availability of EmOC services. Availability of EmOC services was measured by the ability of a health facility to perform the complete set of signal functions and

also the number of facilities that perform the complete set of signal functions in relation to the size of the population. Utilization was measured by finding out the proportion of all births in EmOC facilities and proportion of all women with major direct obstetric complications who were treated in a health facility providing EmOC. Differences in utilization between basic and comprehensive EmOC facilities were compared using Chi-square at p-value <0.05. Quality of EmOC services was measured by obtaining direct obstetric case fatality rate, intra partum and very early neonatal death rate and proportion of maternal deaths due to indirect causes and also calculating proportions of facilities with quality improvement systems.

3.9 ETHICAL CONSIDERATION

The study commenced after getting ethical and scientific approval from Maseno University Ethical Review Committee and the School of graduate Studies, respectively (see Appendix III & IV). Permission from the District Medical Officer of Health Rachuonyo North Sub-County was obtained before data collection (see Appendix V). Permission from hospital administration of all health facilities under study was obtained. Informed consent by voluntary study participants was sought prior to inclusion in the study (see Appendix VI). Confidentiality and privacy was assured. All data was maintained as confidential and no individual was identified in dissemination of findings. Alphanumeric codes were used in the questionnaires to protect privacy of participants. Computers for data entry and analysis had password accessible only to principal investigator. Participants reserved the right of withdrawal at any time of study without penalty. Printed research data was kept in a locked office.

CHAPTER FOUR: RESULTS

4.1 INTRODUCTION

In this chapter results were presented as per the objectives. The sub-topics corresponded to the specific objectives as outlined.

4.2 AVAILABILITY OF EmOC IN RACHUONYO NORTH SUB-COUNTY

Among the 30 facilities assessed, 3 were level IV hospitals, 8 level III while 19 health facilities were level II. Complete set of signal functions were performed by 2 facilities therefore qualifying as EmOC facilities. Level IV mission hospital qualified as comprehensive EmOC facility. One government owned level II health facility qualified as basic EmOC facility (Table 2).

Table 2. Summary of data collected from all surveyed facilities[a]

Facility	[b]Level As per MOH	EmOC status (basic, comprehensive or none)	No. of women giving birth	No. of women with direct obstetric complication treated	No. of C/S	No. of maternal deaths from direct obstetric causes	No. of maternal deaths from indirect causes	No. of intrapartum deaths(fresh stillbirths≥2.5kg) +No.of early neonatal deaths ≤24h
KAH	4	Comprehensive	270	58	123	0	1	8
Okiki A.	3	Basic	135	0	0	0	0	0
Adiedo	2	None	115	0	0	0	0	1
Alum	2	None	53	0	0	0	0	0
Chuowe	2	None	57	0	0	0	0	0
Chuth B	2	None	86	0	0	0	0	0
Got Oyar	2	None	25	0	0	0	0	0
Homa H	3	None	40	0	0	0	0	0
Homa L	3	None	118	0	0	0	0	0
Kajiei	2	None	13	0	0	0	0	0
Kandiege	4	None	616	7	0	2	0	6
Kangir	2	None	2	0	0	0	0	0
Kanya	2	None	10	0	0	0	0	0
Kendu S	4	None	1023	13	0	0	0	19
Kobuya	2	None	59	0	0	0	0	0
Kogweno	2	None	17	0	0	0	0	0
Kosele	2	None	38	0	0	0	0	0
Lela	2	None	23	0	0	0	0	0
Mawego	3	None	5	0	0	0	0	0
Miriu	3	None	372	0	0	0	0	2
Ndere	2	None	4	0	0	0	0	0
Ngeta	2	None	1	0	0	0	0	O
Nyaoga	2	None	57	0	0	0	0	3
Olando	2	None	30	0	0	0	0	0
Omboga	2	None	36	0	0	0	0	0
Oriang	3	None	4	0	0	0	0	0
Oyuma	2	None	9	0	0	0	0	0
Raruowa	3	None	35	0	0	0	0	0
Simbi	2	None	36	0	0	0	0	0
Wagwe	3	None	56	0	0	0	0	0
Totals			**3348**	**78**	**123**	**2**	**1**	**50**

[a] Tally of data collected from all surveyed facilities [b] Level 2 and 3 are expected to provide basic EmOC services, level 4 expected to provide comprehensive EmOC services.

The study finding of 2 EmOC facilities in a total population of 177,587 in the Sub-County translate to 5.6 EmOC per a population of 500,000 and 2.8 comprehensive EmOC facilities per 500,000. Therefore, WHO recommendation of at least 5 EmOC facilities for a population of 500,000 with at least one being comprehensive was met. Table below shows ratio of EmOC facilities to population size in Rachuonyo North Sub-County, Homa Bay County (Table 3).

Table 3. Ratio of EmOC facilities to population size in Rachuonyo Sub-County[a]

Availability of EmOC		**Minimum acceptable level**
No. of EmOC facilities per 500,000 population	5.6 per 500,000 population	≥5 per 500,000 population
No. of comprehensive EmOC facilities per 500,000 population	2.8 per 500000 population	≥1 per 500,000 population

[a] Availability as indicator of EmOC and the acceptable levels.

With regard to provision of signal functions, the least performed function were surgery, blood transfusion and assisted vaginal delivery (e.g. vacuum extraction, forceps delivery). All facilities studied administered parenteral uterotonic drugs (e.g. parenteral oxytocin). Reasons given for not performing signal functions vary from facility to facility but lack of cases and lack of supplies were the dominant reasons. Even though blood transfusion was being done in comprehensive EmOC facilities, they experienced shortages during most times. Caesarean sections were not performed in all level IV hospital due to lack of theatre and theatre equipment.

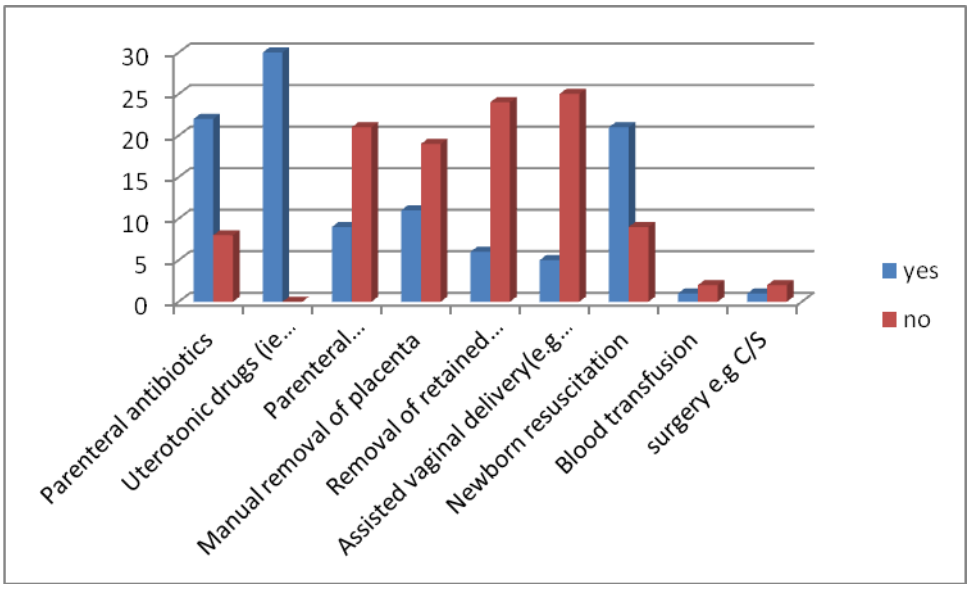


Figure2. Performance of signal functions [a]

[a] Number of health facilities in which each signal function was performed in the last 3 months.

4.3 UTILIZATION OF EmOC IN RACHUONYO NORTH SUB-COUNTY

Utilization of facilities with EmOC services was measured by the proportion of all births in an area that took place in EmOC health facilities (basic or comprehensive). The expected number of all live births was calculated by multiplying the total population of the area by crude birth rate of the same area. The crude birth rate was 35 per 1000 in a population of 177,587 and the estimated total live births were 6216. Therefore, the percentage utilizing EmOC facilities was found to be 6.5% (405) of the total births (Table 4).

Another measure of utilization was the proportion of all women with direct obstetric complications who are treated in a facility providing EmOC services (basic or comprehensive). The expected number of pregnant women who would have major obstetric complications is at 15% of expected births, during the same period in a specified area (McCord et al., 2001). In

Rachuonyo Sub-County the total number of women expected to have obstetric complication were 932. The number of women with direct obstetric complications treated in EmOC facilities in the area was found to be 6.2% (58) as shown in table 4 below. The acceptable level is that 100% of women with complications should be treated in EmOC facilities. The most common direct obstetric complication treated was obstructed labour 59.7% (45) followed by hemorrhage 24.0% (18). Postpartum sepsis was seen in 6.7% (5), severe pre-eclampsia was 5.3% (4), complications of abortion 4.0 % (3) and ruptured uterus was at 1.3% (1). Cases of ectopic pregnancies were not treated in any health facility in Rachuonyo North Sub-County. Caesarean sections as proportion of estimated total live births in the Sub-County were found to be 2.0 % (123) in EmOC facilities and at the same proportion in all surveyed facilities. This was below the 15% as recommended by WHO for level 5.

Table 4. Summary of data from basic and comprehensive EmOC facilities [a]

In 12 month period (July 2014-July 2015)	**Basic EmOC facilities**	**Comprehensive EmOC facilities**	**Total number from EmOC facilities**
No. of facilities	1	1	
Number giving birth	135	270	405
No. of women with direct obstetric complications treated	0	58	58
No. of caesarean sections	0	123	123
No. of maternal deaths from direct causes	0	0	0
No. of maternal deaths from indirect causes	0	1	1
No. of intrapartum deaths(fresh stillbirths≥2.5kg) + No. of very early neonatal deaths(≤24h; ≥2.5kg)	0	8	8

[a] Tally of data collected in EmOC facilities on number of women giving birth, obstetric complications, maternal deaths and neonatal deaths.

There was no significant difference between utilization of EmOC services by women with obstetric complications in basic EmOC facilities and comprehensive EmOC facilities (p>0.05) as shown in table 5 below.

Table 5.Association between number of women giving birth and type of EmOC facility[a]

Type of facility	**Number of women with obstetric complications**			
	EmOC facilities	Non-EmOC facilities	total	*p*-value
Basic EmOC facilities	58	20	78	>0.05[b]
Comprehensive	o	0	0	
total	78	20	78	

[a] Relationship between number of women with obstetric complications and the type of EmOC facility using chi square. [b]Pearson chi square.

4.4 QUALITY OF EmOC IN RACHUONYO NORTH SUB-COUNTY

Even though availability of EmOC was established to be adequate, the Sub-County has insufficient emergency transport vehicles as shown in table 6. Only comprehensive EmOC health facility was found to have a functional ambulance. Again, the same facility had a proper referral system in place with availability of a mobile phone handled by nurse on-call and referral form filled by referring clinicians. Inadequate essential supplies and equipment contributed to non-performance of signal functions. Vacuum extractors, manual evacuation kits, resuscitation equipment and antibiotics were reported to be lacking in some health facilities.

Human resource challenges were noted with inadequate trained staffs across all EmOC health facilities. Total of 4 doctors, 5clinical officers and 35 nurses were deployed in EmOC facilities in the Sub-County. Deficiency of trained workers was more prominent in the basic EmOC facility.

Services were available 24 hours a day in both comprehensive and basic EmOC facilities. Table 6 shows distribution of health work force in EmOC facilities Rachuonyo Sub-County.

Table6. Summary of data from basic, comprehensive EmOC and non-EmoC facilities[a]

Staff	Comprehensive EmOC	Basic EmOC	Non-EmOC
Doctors	4	0	2
Clinical Officers	4	1	10
Nurses	32	3	60
No. of ambulances	1	0	0
Referral letter/phone	1	0	0

[a] Data from checklist in EmOC and non-EmOC facilities

Quality was also measured by obtaining direct obstetric case fatality rate, intra partum and early neonatal death rate and proportions of maternal deaths due to indirect causes relatively crude indicators of quality. Direct obstetric case fatality rate in all surveyed facilities was found to be at 3.45% (2), while in EmOC facilities it was found to be 0% .The recommended value of ≤1% was not met in all surveyed facilities, but it was met in EmOC facilities. The intra partum and very early neonatal death rate was found to be 1.98% in EmOC facilities (obtained by dividing total number of intrapartum deaths and early neonatal deaths by total number of women giving birth in EmOC facilities). Proportion of maternal deaths due to indirect causes in EmOC facilities was 100% (1), while 33.3% was found in all surveyed facilities.

Maternal deaths from both direct and indirect causes were 3 cases. This amount to 3 maternal deaths per 3348 live births in which MMR is estimated at 90 per 100000 live births. This was an estimated value for the Sub-County considering that the data was collected over duration of 1 year as opposed to 5 years as recommended by WHO (WHO and UNICEF, 2009).

CHAPTER FIVE: DISCUSSION

5.1 INTRODUCTION

Discussion of study findings was done in this chapter. Comparison and contrasting the findings with studies was done. Sub-topics were arranged according to the specific objectives.

5.2 AVAILABILITY OF EmOC IN RACHUONYO NORTH SUB-COUNTY

The Sub-County hospitals are required to provide comprehensive EmOC facilities. The MOH therefore classified the two sub-district hospitals as comprehensive EmOC. However, it was evident that the reality on the ground was different. None of these level IV public hospitals qualified for comprehensive EmOC. Similar finding was found in a Malindi District whereby theoretical classification differ from reality on the ground (Echoka *et al*., 2013).

The number of comprehensive EmOC facilities was found to be one which translates to 2.8 per 500,000, WHO recommend ≥1 comprehensive facility per a population of 500,000. Therefore, ratio of comprehensive EmOC facilities to population size was met in Rachuonyo Sub-County. This finding was in agreement with previous studies that comprehensive EmOC are adequate in most regions even in least developed countries (Paxton *et al*., 2005). If the ratio of basic EmOC facilities to population was considered then the acceptable level would not have been met (WHO and UNICEF, 2009).

Availability of EmOC(both basic and comprehensive) facilities remains a critical component of reducing maternal and newborn mortality and morbidity in any maternal health care programme (Kongnyuy *et al*., 2009b). Majority of facilities offering maternity services were not able to provide the full array of signal functions to qualify as EmOC facilities. Difference in provision of signal functions with lack of uniform availability points out challenges in management of the

health system especially in procuring and supplying essential drugs and equipment. Blood transfusion as a key intervention for managing obstetric hemorrhage was hindered by low supply. There was unreliability of availability of blood products across all facilities. The challenge was a result of heavy reliance on regional blood bank for supply. Theatre facilities need to be prioritized in all level IV hospitals to avail surgical options of obstetric care. Theatre services require more human resource and trained staff to run the unit. Availability of supplies and equipment affect ability of midwives and other health personnel at the health facility to make informed decisions, thus promoting maternal and child survival (Olsen *et al*., 2005).

5.3 UTILIZATION OF EmOC IN RACHUONYO NORTH SUB-COUNTY

Health facility deliveries at 53.9%, was a slight improvement with the levels previously seen in the country at 41% (KDHS, 2010). Hospital deliveries in Malawi have been found to be 58% which was slightly higher than our findings (Palamuleni, 2011). This might have resulted from the abolishing of maternity user fees by the government of Kenya in 2013 and was supported by the finding that more women delivered in government-owned health facilities (KDHS, 2014). Free maternity services have motivated many expectant mothers to deliver in the health facilities.

Notably, the percentage of pregnant women utilizing EmOC facilities was found to be 6.5% (405) of the total births. This shows low utilization of both basic and comprehensive EmOC services in the Sub-County. A study done in Malawi showed a higher figure of 20.3% of women utilizing EmOC facilities (Kongnyuy *et al*., 2009a). There was likelihood that obstetric complications were underestimated due to poor recording. The figure of 6.2% of met need for EmOC is lower than expected but similar to findings by other studies that showed 61% of

expected life-threatening maternal conditions did not receive appropriate intervention (Jahn *et al*., 2000). The figure was consistent with the country-wide coverage of basic EmOC at 9% while comprehensive EmOC at 7% (UNFPA, 2015a) which are both low .Though experts anticipates these and propose assuming the proportion to be twice as high, the met need is still only 12.4% (WHO and UNICEF, 2009). High levels of obstetric haemorrhage as obstetric complication was not seen in the sub-County as reported in other studies. Obstructed labour was the predominant obstetric complication seen in the Sub-County. It implied possibility of delays in coming to health facility, delay in reaching hospital and also delays in initiating appropriate treatment (Cecatti *et al*., 2007). The results obtained are in agreement with previous research studies that showed that in low resource countries obstructed labour and sepsis were predominant causes of maternal morbidity and mortality (Baskett, 2008). Although health facilities administered parenteral antibiotics, cases of postpartum sepsis were experienced. Despite free maternity services, low utilization of EmOC services by women with obstetric complications might mean other contributing factors come into play. These include lack of knowledge of EmOC among pregnant mothers, deficiency in basic information on obstetric complications and previous experiences in the health facilities (Leigh *et al*., 1997; Ezeh and Oronje, 2008; Fotso *et al*., 2009).

Caesarean sections as proportion of all births were found to be 2.0% (123) in EmOC facilities and at the same percentage in all surveyed facilities. Although, this was below the WHO recommended level of 5-15%, it was in agreement with findings in a study done in Nigeria (Saidu *et al*., 2013). Studies have also shown that increase in caesarean section from 0-10% is associated with decrease in maternal mortality and stillbirths (McClure *et al*., 2007).

5.4 QUALITY OF EmOC IN RACHUONYO NORTH SUB-COUNTY

Systematic review of literature showed existence of different criteria for clinical audit for quality of obstetric care (Graham *et al*., 2000). The study focused on the guidelines provided by WHO on assessing quality. The number of nurses working in the health facility did not affect ability to offer comprehensive EmOC services, this finding was similar to study done in Tanzania that showed that availability of qualified human resources does not automatically translate to higher quality EmOC services (Olsen *et al*., 2005). This points out to other contributing factors affecting service provision and not entirely human resource availability. These include availability of supplies, continuous staff training, and health policies. Other obstacles to provision of quality EmOC include inefficient referral system and communication. Presence of a working ambulance means timely and effective referral which was lacking in basic EmOC facility. An effective referral system ensures that women with life threatening obstetric complications get timely access to quality EmOC. These include emergency transport and communication services. It also depends on the ability of staff to identify high-risk pregnancies that can be referred to appropriate health facilities where better care can be provided. It also depends on the ability of staff to identify high risk pregnancies that can be referred to appropriate health facilities where better care can be provided (Essendi *et al*., 2010).

High direct obstetric case fatality rate at 6.25% in all surveyed health facilities was an indicator of poor quality maternity services. These preventable deaths could have been avoided if the health facilities were able to provide timely and quality care. Homa Bay County is among the Counties with highest burden of maternal mortality ratio at 583/100,000 live births. The County

was ranked 9th among the 15 Counties that contribute more than 98% of maternal mortality in Kenya (UNFPA, 2015b) . Even though the estimated MMR for the Sub-County of 90/100,000 was lower than national figure at 362/100000 live births, intensifying provision of interventions would further reduce maternal deaths (KDHS, 2010; KDHS, 2014). Studies have shown that to make substantial improvement in the quality of health care to patients, large-scale, system-wide changes must be made. These include routine measurement and reporting of financial incentives for performance (Asch *et al*., 2006; Hussein *et al*., 2010).

The intra-partum and very early neonatal death rate was found to be 1.98% in EmOC facilities, similar findings were obtained in stillbirths for developing countries at 2.1% (Goldenberg *et al*., 2007). Still-births and neonatal deaths could be prevented if proper neonatal resuscitation was made. High percentage of still-births could have been prevented if all pregnant mothers had access to emergency interventions that address obstetric complications.

CHAPTER SIX: SUMMARY, CONCLUSION AND RECOMMENDATION

6.1 SUMMARY OF FINDINGS

Only two health facilities qualified as EmOC service providers. These include a mission hospital providing comprehensive EmOC services and one public health centre offering basic EmOC services. This finding translated to 5.6 EmOC facilities per a population of 500,000 and 2.8 comprehensive EmOC facilities per a population of 500,000.

Hospital deliveries were at 53.9% of total estimated births in the Sub-County, while 6.5% of deliveries occurred in EmOC facilities. Caesarean section rate was found to be 2%. Approximately 6.2% of women with obstetric complications were treated in EmOC facilities. Comprehensive EmOC facility had a functional ambulance and referral system, while it was lacking in basic EmOC facility. Other challenges noted were inadequate supplies, and inadequate human resource. The direct case fatality rate in all surveyed facilities was found to be 6.25%, while in EmOC facilities was 0%. The intra partum and very early neonatal death rate was found to be 1.98% in EmOC facilities while it was found to be 1.42% in non-EmOC facilities. MMR estimate was found to be 90 per 100000.

6.2 CONCLUSION

1. Availability of EmOC service in Rachuonyo north was found to be 5.6 EmOC facilities for a population of 500,000, while comprehensive EmOC facilities was found to be 2.8 per a population of 500,000. The WHO recommendation of at least 5 EmOC facilities for a population of 500,000 with at least one being comprehensive was met.
2. Low utilization of EmOC facilities was noted in the study. Hospital deliveries were lower than expected for the country, which is targeted to reach 100%. Not all women with

obstetric complications received EmOC services; only 6.2% were treated as opposed to 100% as recommended by WHO. Caesarean section rate in the Sub-County (2%) was lower than recommended by WHO at 5-15%.

3. Inadequate resources contributed to low quality of EmOC services in basic EmOC facility. Direct obstetric case fatality in all surveyed facilities was higher than recommended while in EmOC facilities it was equivalent to WHO recommendation of ≤1%.

6.3 RECOMMENDATIONS FROM CURRENT STUDY

1. Maintain constant supply of all drugs and equipment required by health workers to provide EmOC services.
2. Create awareness among the masses on the availability of EmOC service in the Sub-County
3. To have a system to continually monitor quality of services offered in the facilities.

6.4 RECOMMENDATION FOR FUTURE RESEARCH

1. Further research needs to be done on provision of EmOC services especially on larger geographic area to draw significant conclusions.
2. A great deal of research is also needed on quality of EmOC services due to the limitation of numbers in this study.

REFERENCES

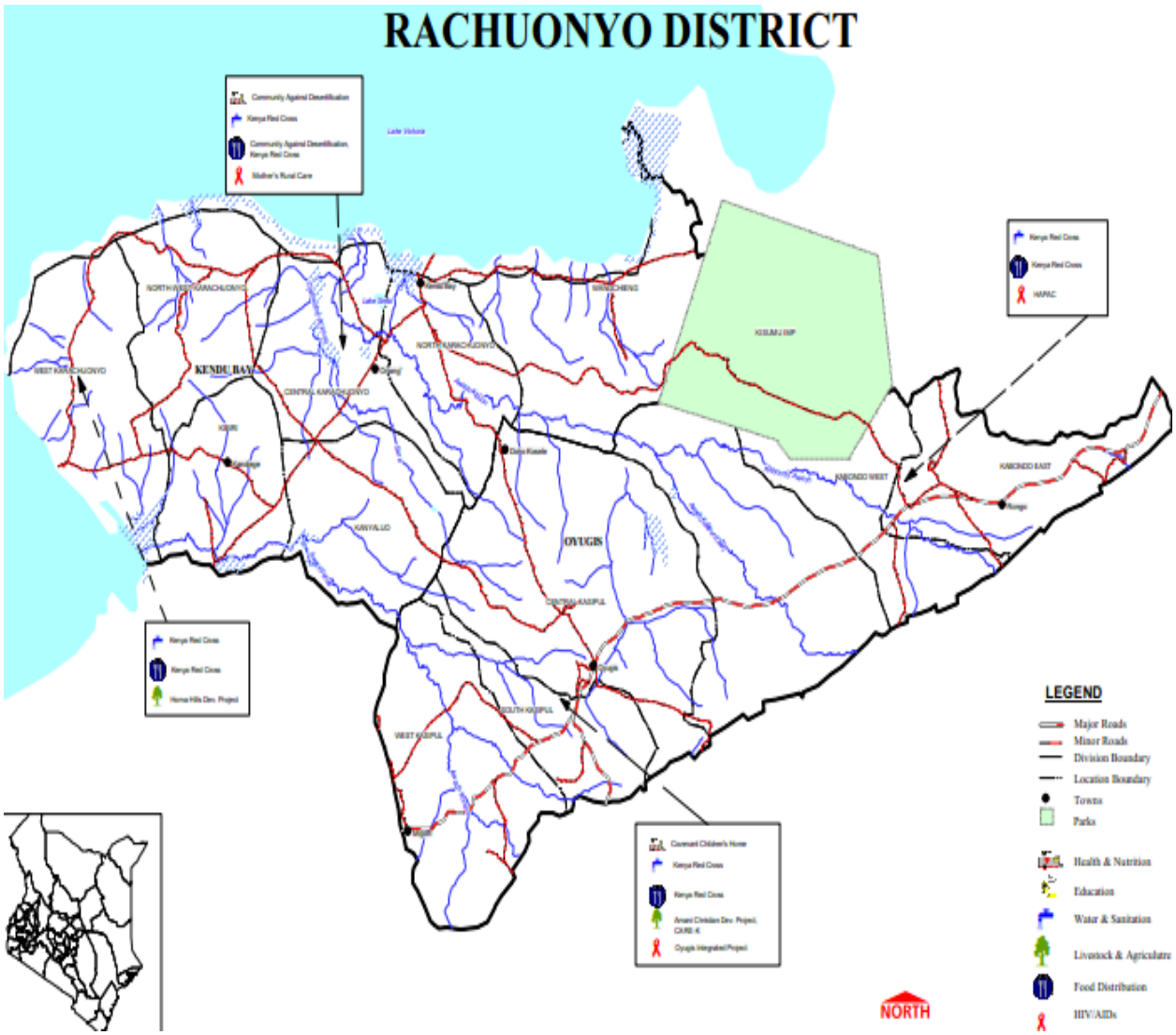
1. Abegunde , D., Kabo , I.A., Sambisa, W., Akomolafe , I., Orobaton, N., Abdulkamm, M. and Sadaoki, H. (2015) Availability, utilization and Quality of emergency obstetric care services in Bauchi state, Nigeria. International Journal of Gynaecology and Obstetrics.
2. Admasi, K., haile- Mariam, A. and Bailey, P. (2011) Indicators for availability, utilization and quality of emergency obstetric care in Ethiopia, 2008. International Journal of Gynaecology and Obstetrics.
3. Ameh, C., Msuya, S., hofman, J. and Raven, J. (2012) Status of emergency obstetric care in six developing countries five years before the MDG targets for maternal and newborn health. Public Library of Science(PLOS) ONE.
4. Anwar, I., Kalim, N. and Koblinsky, M. (2009) Quality of obstetric care in public-sector facilities and constraints to implementing emergency obstetric care services: evidence from high-and low-performing districts of Bangladesh. Journal of health, population, and nutrition 27, 139.
5. Asch, S.M., Kerr, E.A., Keesey, J., Adams, J.L., Setodji, C.M., Malik, S. and McGlynn, E.A. (2006) Who is at greatest risk for receiving poor-quality health care? New England Journal of Medicine 354, 1147-1156.
6. Banke-Thomas Aduragbemi, Wright Kikelomo, Sonoiki Olatunji, Banke-Thomas Oluwasula, Babatunde Ajayi, Ilozumba Onaendo and Akinola Oluwarotimi. (2016) Assessing emergency obstetric care provision in low-and middle-income countries: A systematic review of the application of global guidelines. Global health Action.
7. Baskett, T.F. (2008) Epidemiology of obstetric critical care. Best Practice & Research Clinical Obstetrics & Gynaecology 22, 763-774.
8. Biswas, A.B., Das, D.K., Misra, R., Roy, R.N., Ghosh, D. and Mitra, K. (2005) Availability and use of emergency obstetric care services in four districts of West Bengal, India. Journal of Health Population and Nutrition
9. Cecatti, J.G., Souza, J.P., Parpinelli, M.A., de Sousa, M.H. and Amaral, E. (2007) Research on Severe Maternal Morbidities and Near-Misses in Brazil: What We Have Learned. Reproductive Health Matters 15, 125-133.
10. DMOH. (2014) Rachuonyo North Sub-County Demograhic profile. District medical Officer of Health.
11. Dumont, A. (2012) [How to reduce maternal mortality?]. Bull Academic National Medicine;196(8):1521-32.
12. Echoka, E., Kombe, Y., Dubourg, D., Makokha, A., Evjen-Olsen, B., Mwangi, M., Byskov, J., Olsen, O.E. and Mutisya, R. (2013) Existence and functionality of emergency obstetric care services at district level in Kenya: theoretical coverage versus reality. BMC Health Services Research 13, 113.
13. Essendi, H., Mills, S. and Fotso, J.-C. (2010) Barriers to formal emergency obstetric care services utilization. Journal of Urban Health 88, 356-369.
14. Ezeh, A. and Oronje, R. (2008) Provision and use of maternal health services among urban poor women in Kenya: what do we know and what can we do? Journal of Urban Health 85, 428-442.

15. Fotso, J.-C., Ezeh, A.C. and Essendi, H. (2009) Maternal health in resource-poor urban settings: how does women's autonomy influence the utilization of obstetric care services. Reproductive Health 6, 1-8.
16. Fournier, P., Dumont, A., Tourigny, C., Dunkley, G. and DramÃ, S.k. (2009) Improved access to comprehensive emergency obstetric care and its effect on institutional maternal mortality in rural Mali. Bulletin of the World Health Organization 87, 30-38.
17. Goldenberg, R.L., McClure, E.M. and Bann, C.M. (2007) The relationship of intrapartum and antepartum stillbirth rates to measures of obstetric care in developed and developing countries. Acta Obstetricia et Gynecologica Scandinavica 86, 1303-1309.
18. Graham, W., Wagaarachchi, P., Penney, G., McCaw-Binns, A., Yeboah Antwi, K. and Hall, M.H. (2000) Criteria for clinical audit of the quality of hospital-based obstetric care in developing countries. Bulletin of the World Health Organization 78, 614-620.
19. Hogan, M.C., Foreman, K.J., Naghavi, M., Ahn, S.Y., Wang, M., Makela, S.M., Lopez, A.D., Lozano, R. and Murray, C.J.L. (2008) Maternal mortality for 181 countries, 1980-2008: a systematic analysis of progress towards Millennium Development Goal 5. The Lancet 375, 1609-1623.
20. Hussein, J., Newlands, D., D'Ambruoso, L., Thaver, I., Talukder, R. and Besana, G. (2010) Identifying practices and ideas to improve the implementation of maternal mortality reduction programmes: findings from five South Asian countries. BJOG: An International Journal of Obstetrics & Gynaecology 117, 304-313.
21. Jahn, A., Dar Iang, M., Shah, U. and Diesfeld, H.J. (2000) Maternity care in rural Nepal: a health service analysis. Tropical Medicine & International Health 5, 657-665.
22. KDHS (2010) Kenya Demographic and Health Survey 2008-09. Kenya Central Bureau of StatisticsICF. Central Bureau of Statistics.
23. KDHS. (2014) Kenya Demographic and Health Survey 2014. Kenya Central Bureau of StatisticsICF.
24. Kongnyuy, E.J., Hofman, J., Mlava, G., Mhango, C. and Van Den Broek, N. (2009a) Availability, utilisation and quality of basic and comprehensive emergency obstetric care services in Malawi. Maternal and child health journal 13, 687-694.
25. Kongnyuy, E.J., Hofman, J.J. and van den Broek, N. (2009b) Ensuring effective Essential Obstetric Care in resource poor settings. BJOG: An International Journal of Obstetrics & Gynaecology 116, 41-47.
26. Leigh, B., Kandeh, H.B.S., Kanu, M.S., Kuteh, M., Palmer, I.S., Daoh, K.S. and Moseray, F. (1997) Improving emergency obstetric care at a district hospital, Makeni, Sierra Leone. International Journal of Gynecology & Obstetrics 59, S55-S65.
27. McClure, E.M., Goldenberg, R.L. and Bann, C.M. (2007) Maternal mortality, stillbirth and measures of obstetric care in developing and developed countries. International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics 96, 139-146.
28. McCord, C., Premkumar, R., Arole, S. and Arole, R. (2001) Efficient and effective emergency obstetric care in a rural Indian community where most deliveries are at home. International journal of gynaecology and obstetrics 75, 297-307.
29. Mkoka, D.A., Goicolea, I., Kiwara, A., Mwangu, M. and Hurtig, A.K. (2014) Availability of drugs and medical supplies for emergency obstetric care: experience of

health facility managers in a rural District of Tanzania. BMC Pregnancy Childbirth. 2014 Mar 19;14(1):108. doi: 10.1186/1471-2393-14-108.
30. MOH. (2005) Reversing the TrendsnThe Second national Health Sector Strategic plan of Kenya. Ministry of Health. health sector reform secretariat.
31. MOH. (2006) Norms and Standards for Health Service delivery. Ministry of Health. health sector reform secretariat.
32. MOPHS and MMS. (2012) National guidelines for quality obstetric and perinatal care. Ministry of Public Health and Sanitation and Ministry Of Medical Services
33. NCAPD and Development, M.o.P.a.N. (2005) Rachuonyo District, District strategic plan 2005-2010 by National Co-ordinating Agency for Population and Development and Ministry of Planning and National Development.
34. Nesbitt, R.C., Lohela, T.J., Manu, A., Vesel, I., Okyere, E. and Edmond, K. (2013) Quality along the continuum: a health facility assessment of intrapartum and postnatal care in Ghana. Public Library of Science (PLOS) One.
35. Okong, P., Byamugisha, J., Mirembe, F., Byaruhanga, R. and Bergstrom, S. (2006) Audit of severe maternal morbidity in Uganda – implications for quality of obstetric care. Acta Obstetricia et Gynecologica Scandinavica 85, 797-804.
36. Olsen, Ã.y.E., Ndeki, S. and Norheim, O.F. (2005) Availability, distribution and use of emergency obstetric care in northern Tanzania. Health Policy and Planning 20, 167-175.
37. Pacagnella, R.C., Cecatti, J.G., Osis, M.J. and Souza, J.o.P. (2012) The role of delays in severe maternal morbidity and mortality: expanding the conceptual framework. Reproductive Health Matters 20, 155-163.
38. Palamuleni, M. (2011) Determinants of non-institutional deliveries in Malawi. Malawi Medical Journal 23, 104-108.
39. Paxton, A., Maine, D., Freedman, L., Fry, D. and Lobis, S. (2005) The evidence for emergency obstetric care. International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics 88, 181-193.
40. Saidu, R., August, E.M., Alio, A.P., Salihu, H.M., Saka, M.J. and Jimoh, A.A.G. (2013) An assessment of essential maternal health services in Kwara state, Nigeria. African journal of reproductive health 17, 41-48.
41. UNFPA. (2015a) Accelerating the attainment of MDG5 in Kenya. Focus on the 15 counties with the highest burden of maternal deaths. UNFPA report.
42. UNFPA. (2015b) Counties with highest burden of maternal mortality. UNFPA report.
43. WHO, U. and UNICEF. (2009) AMDD: Monitoring emergency obstetric care: a handbook. Geneva, Switzerland: WHO, 1-164.
44. Ziraba, A., Samuel, m., Nyovani, m., Teresa, S. and Jean-Christopher, F. (2009) The state of emergency obstetric care services in nairobi informal settlements and environs: Results from a maternity health facility survey. BioMedCentral Health Services Research.

APPENDICES

APPENDIX I: MAP OF RACHUONYO



APPENDIX II: DATA COLLECTION TOOLS

Form 1. Possible EmOC facilities

1. Name of area_____

2. Population of area_____

3. Crude birth rate of area____

4. Total number of health centers, health clinics and nursing homes _____

5. Total number of hospitals_____

7. List of dispensaries, health centers and clinics

Area (sub-County) _____

Facility name	location	Type of facility(health centre, dispensary)	ownership

Total number of facilities that are not hospitals but offer some maternity care _____

8. List of hospitals

Area (sub-County) _____

Facility name	location	Type of facility(sub-County hospital, County hospital)	Ownership(government, private, mission)

Total number of hospitals offering maternity care _____

CHECK LIST

Facility name	No. of Doctors	No. of Clinical officers	No. of nurses	Maternal mortality audits	Working ambulance/referral system	Rapid response initiative	CME/capacity building among staff

Code number_____

9. Performance of signal functions (section to be administered to Maternity in-charges)

item	Performed in the past 3months?	If not performed in past 3months, why?
a)administer parenteral antibiotics	0=no 1=yes	1=training issues 2=supplies

		3=management issues 4=policy issues 5=no indication
b) administer uterotonic drugs(i.e. parenteral oxytocin)	0=no 1=yes	1=training issues 2=supplies 3=management issues 4=policy issues 5=no indication
c) Administer parenteral anticonvulsants for pre-eclampsia (i.e. magnesium sulfate)	0=no 1=yes	1=training issues 2=supplies 3=management issues 4=policy issues 5=no indication
d)perform manual removal of placenta	0=no 1=yes	1=training issues 2=supplies 3=management issues 4=policy issues 5=no indication
e) perform removal of retained products (e.g. manual vacuum evacuation, dilatation and curettage)	0=no 1=yes	1=training issues 2=supplies 3=management issues 4=policy issues 5=no indication
f) perform assisted vaginal delivery (e.g. vacuum extraction, forceps delivery)	0=no 1=yes	1=training issues 2=supplies 3=management issues 4=policy issues 5=no indication
g)perform newborn	0=no	1=training issues

resuscitation (e.g. with bag and mask)	1=yes	2=supplies 3=management issues 4=policy issues 5=no indication
h)Perform blood transfusion	0=no 1=yes	1=training issues 2=supplies 3=management issues 4=policy issues 5=no indication
i)perform surgery (e.g. caesarean section)	0=no 1=yes	1=training issues 2=supplies 3=management issues 4=policy issues 5=no indication

KEY

Training issues: authorized cadre is available but not trained, or there is lack of confidence in providers' skills

Supplies, equipment issue: supplies are not available, not functional or broken, or needed drugs are unavailable.

Management issues: Providers desire compensation to perform this function, providers are encouraged to perform alternative procedures, or providers uncomfortable or unwilling to perform procedure for reasons unrelated to training.

Policy issues: required level of staff is not posted to this facility in adequate numbers (or at all), or national or hospital policies do not allow function to be performed.

No indication: no client needing this procedure came to the facility during this period

10. Facility case summary

(To be completed by reviewing facility register)

Month(write name of month above each number)													
year	1	2	3	4	5	6	7	8	9	10	11	12	total
No. of women giving birth													
No. Caesarean section													
Direct obstetric complications treated													
Hemorrhage (ante- and postpartum)													
Obstructed or prolong labor													
Ruptured uterus													
Postpartum sepsis													
Severe pre-eclampsia or eclampsia													
Complications of abortion(with hemorrhage or sepsis)													
Ectopic pregnancy													
Total no. of direct obstetric complications treated(add each													

column)													
Maternal deaths from direct causes													
Hemorrhage (ante- and postpartum)													
Obstructed or prolong labor													
Ruptured uterus													
Postpartum sepsis													
Severe pre-eclampsia or eclampsia													
Complications of abortion(with hemorrhage or sepsis)													
Ectopic pregnancy													
Total no. of maternal deaths from direct obstetric causes (add each column)													
Still births and neonatal deaths													
Intra partum deaths(fresh still births) ≥2.5kg													
Very early neonatal deaths(≤24h)≥2.5kg													

APPENDIX III: APPROVAL FROM SCHOOL OF GRADUATE STUDIES

MASENO UNIVERSITY
SCHOOL OF GRADUATE STUDIES
Office of the Dean

Our Ref: PG/MPH/06020/2012

Private Bag, MASENO, KENYA
Tel:(057)351 22/351008/351011
FAX: 254-057-351153/351221
Email: sgs@maseno.ac.ke

Date: 02nd February, 2015

TO WHOM IT MAY CONCERN

RE: PROPOSAL APPROVAL FOR CHERUIYOT A. KPYEGON— PG/MPH/06020/2012

The above named is registered in the Master of Public Health Programme of the School of Public Health & Community Development, Maseno University. This is to confirm that his research proposal titled "Assessment of the Provision of Emergency Obstetric Care Services and Maternal Mortality Ratio in Rachuonyo North Sub-County, Homabay County, Kenya" has been approved for conduct of research subject to obtaining all other permissions/clearances that may be required beforehand.

MASENO UNIVERSITY
DIRECTOR
3 - FEB 2015
SCHOOL OF GRADUATE STUDIES

Prof. P.O. Ochogi
DEAN, SCHOOL OF GRADUATE STUDIES

APPENDIX IV: ETHICAL APPROVAL

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

Tel: +254 057 351 622 Ext: 3050
Fax: +254 057 351 221
Private Bag – 40105, Maseno, Kenya
Email: muerc-secretariate@maseno.ac.ke

FROM: Secretary - MUERC

DATE: 9th June 2015

TO: Andrew Kipyegon Cheruiyot
PG/MPH/06020/2012
Department of Public Health
School of Public Health and Community Development
P. O. Box Private Bag, Maseno, Kenya

REF: MSU/DRPI/MUERC/000145/15

RE: Assessment of the Provision of Emergency Obstetric Care Services and Maternal Mortality Ratio in Rachuonyo North Sub-County, Homa Bay County, Kenya. Proposal Reference No: MSU/DRPI/MUERC/000145/15

This is to inform you that the Maseno University Ethics Review Committee (MUERC) determined that the ethics issues raised at the initial review were adequately addressed in the revised proposal. Consequently, the study is granted approval for implementation effective this 9th day of June, 2015 for a period of one (1) year.

Please note that authorization to conduct this study will automatically expire on 8th June, 2016. If you plan to continue with the study beyond this date, please submit an application for continuation approval to the MUERC Secretariat by 6th May, 2016.

Approval for continuation of the study will be subject to successful submission of an annual progress report that is to reach the MUERC Secretariat by 6th May, 2016.

Please note that any unanticipated problems resulting from the conduct of this study must be reported to MUERC. You are required to submit any proposed changes to this study to MUERC for review and approval prior to initiation. Please advice MUERC when the study is completed or discontinued.

Thank you.

Yours faithfully,

Dr. Bonuke Anyona,
Secretary,
Maseno University Ethics Review Committee.

Cc: Chairman,
Maseno University Ethics Review Committee.

MASENO UNIVERSITY IS ISO 9001:2008 CERTIFIED

APPENDIX V: APPROVAL FROM DMOH

REPUBLIC OF KENYA

MINISTRY OF PUBLIC HEALTH AND SANITATION

Telegrams: "Medical" Kendubay.
Telephone:
When replying, please quote
E mail: dmohrachuonyonorth@gmail.com

District Medical Officer of Health
Rachuonyo North Sub County
P.O. Box 47-40301
Kendu-Bay

SUB-COUNTY MEDICAL OFFICER OF HEALTH,
RACHUONYO NORTH SUB-COUNTY
Kendu bay
14 / 07 / 2015

To All Health Facility In-Charges
Rachuonyo North Sub-County,

Dear Sir / Madam,

RE F: PERMISSION TO CARRY OUT A RESEARCH STUDY

Permission has been granted to Mr. Andrew Kipyegon Cheruiyot , a student from Maseno University , to collect data for the research study on the topic ASSESSMENT OF Provision of Emergeny Obstetric Care Services and Maternal Mortality Ratio in Rachuonyo North Sub – County, Homa Bay County , Kenya.

His team will be visiting all health facilities in Rachuonyo North Sub –County to carry out the exercise.

Accord him all the necessary assistance

Thank you

Yours sincerely,

KENDU BAY SUB-DISTRICT HOSPITAL Date 14/07/2015 P.O. Box 47 KENDU BAY

Dr. Ochola E. Okal

Sub – County Medical Officer of Health.

APPENDIX VI: INFORMED CONSENT

I am carrying out a research on the Provision of Emergency Obstetric Care Services and maternal mortality ratio in Rachuonyo North Sub-County, Homa Bay County, Kenya. The purpose of this research is to be presented in partial fulfillment for the requirement of Master of Public Health Degree.

If you accept to participate in the study, I will administer to you a structured questionnaire which will take approximately 20 minutes to complete. There are no direct benefits to you but the information collected will help health workers to plan future programs for emergency obstetric care in order to improve the availability, utilization and quality of these services in Rachuonyo North Sub-County. The information gathered during the research will remain confidential and participants will remain anonymous since the names will not be required.

Participation in this study is voluntary. . If you feel uncomfortable with any question you are free to contact me at 0724083236 or Maseno University ethics review committee at private bag, Maseno, Kenya for further clarifications.

By signing this form below, you indicate that you have agreed to participate in this research.

Signature of participant: _____

Date signed: _____

Signature of witness_____