

**ANNUAL TRENDS OF CAESAREAN SECTION RATES,
INDICATIONS, FETAL AND MATERNAL OUTCOMES AT
MANDERA COUNTY REFERRAL HOSPITAL, MANDERA COUNTY
KENYA, 2013 -2017**

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**MMed (Obstetrics and Gynecology) Dissertation
Muhimbili University of Health and Allied Sciences
October, 2019**

**Muhimbili University of Health and Allied Sciences
Department of Obstetrics and Gynecology**



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By

Dr. Kala Hassan Adan, (MD)

**A dissertation submitted in (Partial) Fulfillment of the Requirements for the degree
of Master of Medicine (Obstetrics and Gynecology) of**

**Muhimbili University of Health and Allied Sciences
October, 2019**

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by the Muhimbili University of Health and Allied Sciences a dissertation entitled: *“Annual trends of caesarean section rates, indications, fetal and maternal outcomes at Mandera County Referral Hospital, Mandera County Kenya, 2013-2017”* in partial fulfillment of the requirements for the degree of Master of Medicine (Obstetrics and Gynecology) of the Muhimbili University of Health and Allied Sciences.

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(Supervisor)

Date



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(Co-Supervisor)

DECLARATION AND COPYRIGHT

I, **Dr. Kala Hassan Adan** declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature..... Date.....

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ACKNOWLEDGEMENT

First and foremost praise The Almighty GOD for his blessings and guidance throughout my studies and the work of proposal development and dissertation write up.

I wish to express my sincere gratitude and appreciation to Dr Belinda Balandya and Dr Ali Abdi Adan, for their supervision, guidance and encouragement from the beginning of the research proposal preparation through to the final draft write-up of the dissertation.

I am also grateful and indebted to all the consultants and specialists in the department of Obstetrics and Gynecology, Muhimbili University of Health and Allied Sciences .For their constructive criticisms and guidance throughout all the stages of the dissertation work.

My appreciation is also extended to my employer Mandera County Government, Department of Health services as well as the management and staffs at Mandera County Referral Hospital, Mandera County, Kenya. Their support and encouragement during the field work of data collection immensely contributed to the success of the study.

DEDICATION

This work is dedicated to my extended Kala Dido's family, in memory of my late grandfather Mr. Kala Dido Adow. I also dedicate it to my parents Mr. Adan Kala Dido and Mrs. Hafwsa Sheikh Omar, my lovely spouse Mrs. Marian Alio Mohamed whose support was instrumental in achievement of my academic goals inclusive of this dissertation and lastly to my beautiful daughters Siham, Humaira and Manha.

ABSTRACT

Background: Caesarean section (CS) is the most common surgical procedure performed in obstetrics practice, with the sole aim of reducing fetomaternal morbidity and mortality. Worldwide and institutional based studies have shown increasing trend in CS. The aim of the study was to determine the annual trends in caesarean section rates, indications, fetal and maternal outcomes at Mander County Referral Hospital (MCRH), Mander County, Kenya.

Methodology: A hospital based descriptive cross-sectional study of women (n=783) who underwent caesarean section at Mander County Referral Hospital, Mander County, Kenya from 1st January 2013 to 31st December 2017, was performed. Data on socio-demographic and obstetric characteristics, indications for CS, fetal and maternal outcomes were extracted from the women's medical records using a structured checklist by two trained research assistants. Analysis was done using the Statistical Package for Social Sciences (SPSS) version 23.0. Categorical variables were summarized using frequency and proportions, the linear trend over time was determined by chi-square using the statistical software EpiInfo, with a p-value of less than 0.05, considered to be statistically significant.

Results: During the period under review (2013-2017), a total of 7,613 deliveries were recorded, amongst them, 783 were caesarean sections (10.3%). Emergency caesarean section was more prevalent than elective caesarean section (96.3% vs 3.7%). The most common indication for CS was previous caesarean section at (23.7%). The most frequent adverse fetal and maternal outcomes were new born unit admission (13.2%) and blood transfusion (35.9%), the overall case fatality rate was (2.1%). Trend analysis for blood transfusion over the 5 years was significantly decreasing with a p-value of 0.007*.

Conclusion: The average caesarean section rate at Mander County Referral Hospital, Mander County, Kenya, over the study period under review stands at 10.3%. The key findings of the study were the high frequency of adverse fetomaternal outcomes among participants who underwent caesarean sections.

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LIST OF ABBREVIATIONS

AKUH	-	Aga Khan University Hospital
CS	-	Caesarean Section
ECS	-	Emergency Caesarean Section
END	-	Early Neonatal Death
HIRS	-	Hospital Information Record System
KCMC	-	Kilimanjaro Christian Medical Centre
KDHS	-	Kenya Demographic Health Survey
KEMRI-SERU-		Kenya Medical Research Institute Scientific and Ethics Review Unit
MCG	-	Mandera County Government
MCRH	-	Mandera County Referral Hospital
MCSA	-	Mandera County Statistical Abstract
MNH	-	Muhimbili National Hospital
PCS	-	Planned Caesarean Section
SBF	-	Still Birth Fresh
SBM	-	Still Birth Macerated
TDHS	-	Tanzania Demographic Health Survey
TZS	-	Tanzanian Shilling
WHO	-	World Health Organization
WHOGS	-	World Health Organization Global Survey of Maternal and Perinatal Health
WHOMCS	-	World Health Organization Multi-Country Survey of Maternal and Newborn Health

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Caesarean section(CS) is a surgical procedure that involves the delivery of the fetus, placenta and membranes after the period of viability through an abdominal and uterine incision (1). Based on the timing of the procedure, two distinct types are distinguished; emergency caesarean section and planned caesarean section. Emergency caesarean section (ECS) is an unplanned or unscheduled procedure that is necessitated by an urgent need for delivery. Planned caesarean section (PCS) on the other hand depends on the decision to deliver the fetus as a scheduled procedure, where the client is then admitted and the procedure performed at a specified time.

World Health Organization (WHO) in 1985 recommended the optimal population-based caesarean section rate of 5 to 15% (2), lower rates suggest the unmet need, while higher rates suggest the improper selection. The above recommendation was reviewed in 2015 due to the documented upward trend in CS rates in developed and developing countries, with a recommendation that every effort should be made to provide CS to a woman in need than striving to achieve a specific rate. Population-based recommendations on CS rates cannot be applied as ideal to health facilities, based on the fact that a facility based CS rates are influenced by several predictors such as obstetrics case mix handled, capacity of the facility in terms of human resource and infrastructure, as well as local protocols adhered to within the departments (3).

Worldwide there is an upsurge in caesarean section trends, largely attributed to increased safety in terms of better surgical technique, improved anesthesia, and the advent of effective antibiotics and availability of blood and blood products for transfusion (4). At the same time both primary caesarean section and repeat caesarean section rates are on the increase, attributed to the caesarean section on maternal request and decline in vaginal birth after caesarean section (5). The increasing trend in caesarean section elicited public health concern due to the increased financial burden, more so in the developing countries as the caesarean section is far more costly in comparison to vaginal delivery (6).

Caesarean sections are performed for fetal and maternal indications. At present, there is no accepted standardized classification system for caesarean section indications (7). The resultant challenges for practitioners are the multiple indications that seem to overlap. For example, among the commonest indication for caesarean section is obstructed labour which can result from both maternal and fetal factors (Cephalopelvic disproportion, Malpresentation, Fetal macrosomia).

Lack of a single caesarean section (CS) classification system thus makes auditing, analyzing and comparing CS rates across different settings practically unfeasible. To address the above challenge WHO proposes the Robson's classification system as a global standard for assessing, monitoring and comparing caesarean section rates within healthcare facilities over time, and between facilities (3).

Robson's classification also referred to as the 10 group classification, proposes a system that classifies all deliveries into one of the 10 groups on the basis of the five parameters: obstetric history (parity, previous CS), onset of labour (spontaneous, induced or CS before onset of labour), fetal presentation or lie (cephalic, breech or transverse), number of neonates and gestation age (preterm or term) without considering indication for CS (3,7,8). The main strengths of the Robson classification are the simplicity of its design, the validity of its purpose, and the ease of its implementation and the directness of its initial interpretation (9).

Although worldwide there is a significant reduction in the caesarean section related morbidities and mortalities over the years, the procedure still carries significant adverse effects to both the mother and the infants. Maternal adverse effects include iatrogenic injuries to adjacent viscera (ureters, bladder and bowel), hemorrhage, infection and blood transfusion. Adverse neonatal outcomes include prematurity, birth trauma and transient tachypnoea of the newborn (10).

At Mandera Country Referral Hospital (MCRH), caesarean section has been performed for over several decades due to fetal and maternal indications. Both the indications, fetal and maternal outcomes are universal worldwide, with wide variations in rates of occurrence. This study was undertaken to review the trend, indications, fetal and maternal outcomes of caesarean section at MCRH. This study will shed light on vital statistics on caesarean section, a crucial aspect of maternal and child health.

1.2 Literature Review

Globally over the past three decades, trends in caesarean section (CS) are on the upsurge, more so in the high and middle income countries. Two WHO Multi-Country Studies, WHO global survey of maternal and perinatal health (WHOOGS, 2004-2008) and WHO multi-country survey of maternal and newborn health (WHOMCS, 2010-2011), showed the overall increase in CS rate between the two surveys of (26.4%) and (31.2%) respectively (11–13). Country based CS rate ranged from (46.2%) in China to (5.3%) in Niger in WHOOGS (2004-2008) and from (47.6%) in China to (9.8%) in Niger in the WHOMCS (2010-2011). Caesarean section rates increased overtime between the two WHO surveys in all countries except Japan, where slight decline in CS rate was noted from 19.8% to 18.6% (11,12).

Based on the global, regional and national estimates: 1990-2014, which involved data from 150 countries, (18.6%) of all births occurred via CS, ranging from (6%) to (27.2%) in the least and most developed regions respectively. Latin America and the Caribbean region have the highest CS rates (40.5%), followed by Northern America (32.3%), Oceania (31.1%), Europe (25%), Asia (19.2%) and Africa (7.3%). Based on the data from 121 countries, the trend analysis showed that between 1990 to 2014, the global average CS rate increased by 12.4% from (6.7% to 19.1%) with an average annual rate of increase of 4.4% (14).

Caesarean section rates in African countries are low compared to the rest of the world, but trends are commensurate with the rest of the world. Based on the global, regional and national estimates (1990-2014), CS rates in Africa increased from 2.9% to 7.4% (14). Country specific rates as per the WHOOGS were as follows: Uganda (15.1%), Nigeria (14.5%), Democratic Republic of Congo (13.1%), and Niger (5.3%) (11,13).

Among the East African Countries a geographical group recognized by The United Nations, birth by CS stands at (3.9%) with a range of (1.5% - 9.6%) (14). Based on Tanzania demographic health survey (TDHS) a 3% increase in CS rate was noted from 2004 to 2016 (15,16). Also noted was glaring regional variation of CS rates across Tanzania from as high as 17% in Dar es Salaam to as low as 1% in Katavi (15–17).

Two institutional based studies, undertaken at the tertiary care hospitals in Tanzania showed an increase in CS rates by 16% at Muhimbili National Hospital from 1999-2005 and 5.6% at Kilimanjaro Christian Medical Centre from 2005-2010 (18,19).

Based on the WHOGS (2004-2005) and WHOMCS (2010-2011), an increase of 7.7% was noted in the CS rates in Kenya (11,13,20). Kenya demographic health survey (KDHS), also shows a 2.5% increase in the CS rate from 2008 to 2014 (21,22). Varying trends in the CS rates have been demonstrated among counties across Kenya, with a rate of 20.7% in Nairobi, to 1% in Wajir (22).

A hospital-based study undertaken at the Aga Khan University Hospital, Nairobi (AKUH), between 2001-2004, showed a 12.2% increase in the overall CS rate (23). A multicentre study undertaken in 2001 also revealed a high CS rates for Pumwani Maternity Hospital (7.8%), Nairobi Hospital (28.3%) and Kenyatta National Hospital (28.5%) (24).

Indications for the caesarean section are uniform worldwide. Broadly distinguished as maternal and fetal indications for CS. Maternal indications for the CS include; previous caesarean section, cephalopelvic disproportion, abnormal placentation, pelvic reconstructive surgery, full thickness myomectomy and genital warts. Fetal indications for the CS includes; non-reassuring fetal status, malpresentation, macrosomia and congenital anomalies (25). Several studies undertaken in both the developed and the developing countries have shown that a previous caesarean section was the most common indication, these was attributed to the increasing number of primary caesarean sections as well a significant reduction in the number of vaginal birth after caesarean section (10,19,26–28). In the developed countries a significant proportion of the CS indication is taken up by caesarean delivery by maternal request (CDMR), this was clearly demonstrated by a study done in China which showed the proportion of CDMR of (9.99%) and (1.83%) for 2011 and 2014 respectively (26).

Caesarean section is associated with numerous maternal morbidity and mortality; blood transfusion (0.4%), hysterectomy (0.1%), maternal death or ICU admission (0.2%) and prolonged hospital stay more than 7 days (0.7%). The above listed complications are more prevalent in emergency CS as compared to planned CS (4,12,29). Of note is the increased level of infections associated with the caesarean delivery in hospitals in developing countries (29). Adverse fetal and maternal outcomes are also related with the indication of CS i.e. preeclampsia increases the risks of maternal death, fresh still birth and severe neonatal morbidity (13).

Adverse fetal outcomes associated with caesarean section (CS) include; still birth, neonatal death and severe neonatal morbidity (admission to new born unit, low Apgar score). Emergency caesarean sections are associated with more incidences of adverse fetal outcomes in comparison to elective caesarean sections (4,13).

1.3 Conceptual Framework

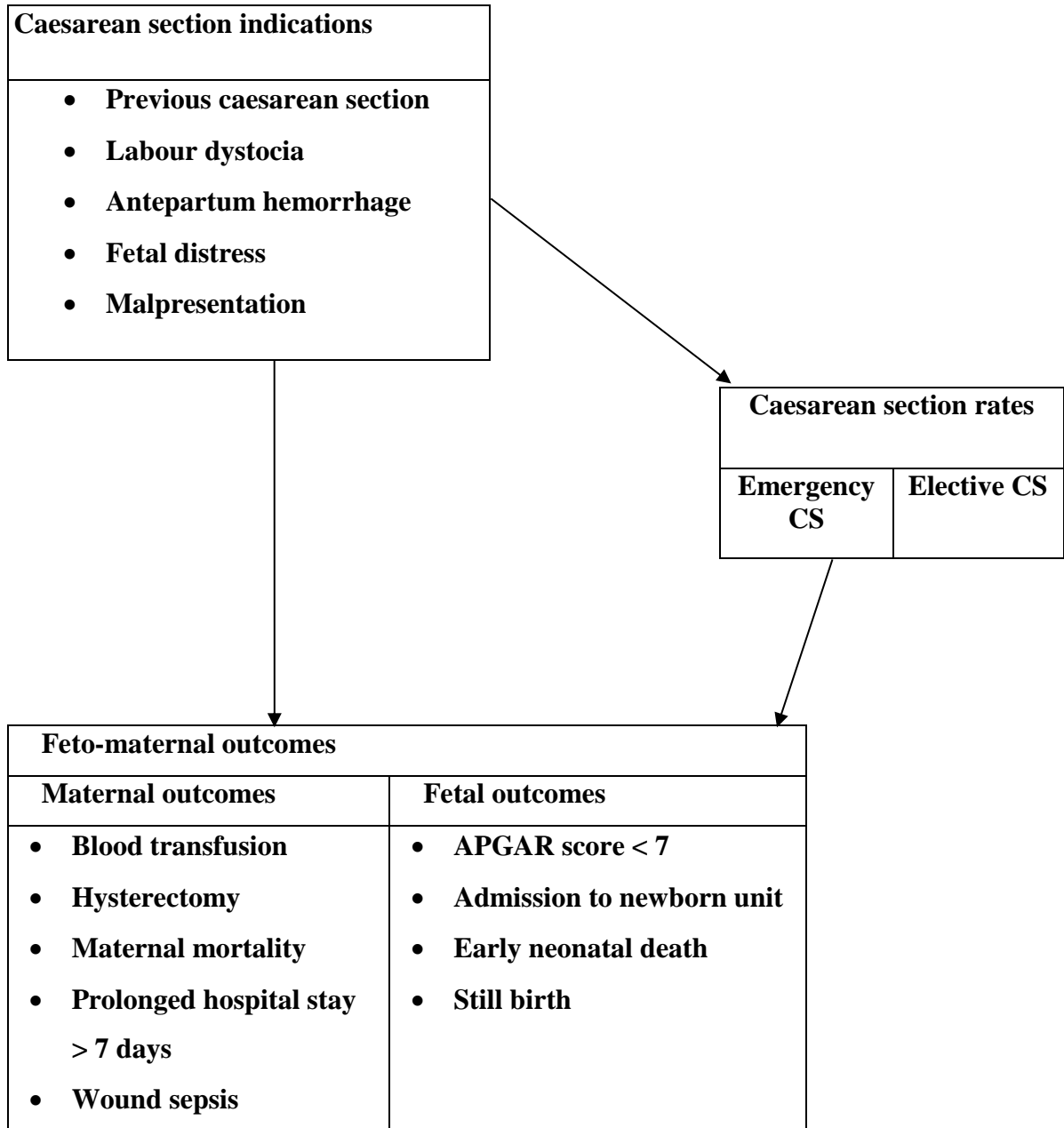


Figure 1: Conceptual framework of annual trends in caesarean section rates, indications and feto-maternal outcomes

Description of Conceptual Framework

Trends of the cesarean section rates is on the increase for the past years, whose indications are ; previous caesarean section, labour dystocia, antepartum hemorrhage, fetal distress and malpresentation. Emergency or elective CS is linked to a number of adverse fetomaternal outcomes; Apgar score < 7, admission to a newborn unit, early neonatal death, still birth, maternal blood transfusion, hysterectomy, maternal mortality, prolonged hospital stay > 7 days and wound sepsis. This study will determine the current trends in cesarean section rates, indications and fetomaternal outcomes at Mandera County Referral Hospital, Mandera County, Kenya.

1.4 Problem Statement

Caesarean section is the most common lifesaving procedure done in obstetric practice to reduce the incidence rate of fetal and maternal morbidities and mortalities (2).

In recent years, there are concerns by the community about the increasing trend of caesarean section at Mandera County Referral Hospital (MCRH), resulting in the rising scenarios of patients declining consent for caesarean section. Based on the unpublished hospital data for the first quota of 2018, the average caesarean section rate for the months of January, February and March was 8.5%, which is approximately five times the county's average CS rate of 1.8%, but corresponds to the country's average CS rate of 8.7% (22).

No study has been undertaken at MCRH to clarify the current trend in caesarean section rate, as well as determine the indications, fetal and maternal outcomes of caesarean sections. Thus due to this paucity of data there is a need to conduct a scientific study to review the trends and the outcomes progressively to establish the concern.

1.5 Rationale

The study once undertaken will illuminate on general quality of obstetric care and will provide crucial data on caesarean section rates, indications, fetal and maternal outcomes over the study duration.

Analysis of the data and its dissemination to the community and relevant stakeholders can facilitate improvement in the quality of care and provide data that can be used as reference for future research purpose.

1.6 Research Question

What are the annual trends of caesarean section rates, indications, fetal and maternal outcomes at Mandera County Referral Hospital, from 1st January 2013 – 31st December 2017?

1.7 Objectives

1.7.1 Broad objective

To determine the annual trends of caesarean section rates, indications, fetal and maternal outcomes at Mandera County Referral Hospital (MCRH) from 1st January 2013 - 31st December 2017.

1.7.2 Specific objectives

1. To determine the annual trends of caesarean section rates.
2. To determine the annual trends of indications for caesarean section.
3. To determine the annual trends of feto-maternal outcomes in caesarean section.

CHAPTER TWO

2.0 METHODOLOGY

2.1 Study Design

This was a hospital-based descriptive cross sectional study of deliveries conducted at Mandera County Referral Hospital, Mandera County, Kenya, from 1st January 2013 to 31st December 2017.

2.2 Study Duration

This cross sectional study was conducted from 2nd January 2019 to 28th February 2019.

2.3 Study setting

The study was undertaken at the department of Obstetrics and gynecology, Mandera County Referral Hospital, Mandera County Kenya.

Mandera County, county number 009, is one of the remotest and underprivileged of the 47 county governments established under the Kenyan constitutional dispensation of 2010, forming the devolved units with the aim of bringing essential services closer to the population. Health care was among the key devolved functions.

Mandera is located in the North Eastern region of Kenya. It borders Ethiopia to the North, Somalia Republic to the East, and Wajir County to the South and South West. The county covers an area of 25,797.70 Km² and has a total population of 1,025, 756 (30). See **Figure 2**

The County has a fully-fledged health department with the sole mandate of providing quality evidence based health care to the population. Regarding the Maternal and Child indicators, the county has recently been in the limelight due to alarming trend in maternal and neonatal death rate. The latest estimate of the County's maternal mortality ratio (MMR) is 3795 deaths per 100,000 live births, which is ten times the national average of 362 deaths per 100,000 live births (22). The county's average fertility rate stood at 5.2, which is way higher than the national average of 3.9 (31). With regards to the neonatal mortality rate, the county is at 24 per 1000 live births which is slightly higher than the country's average of 22 per 1000 live births (31).

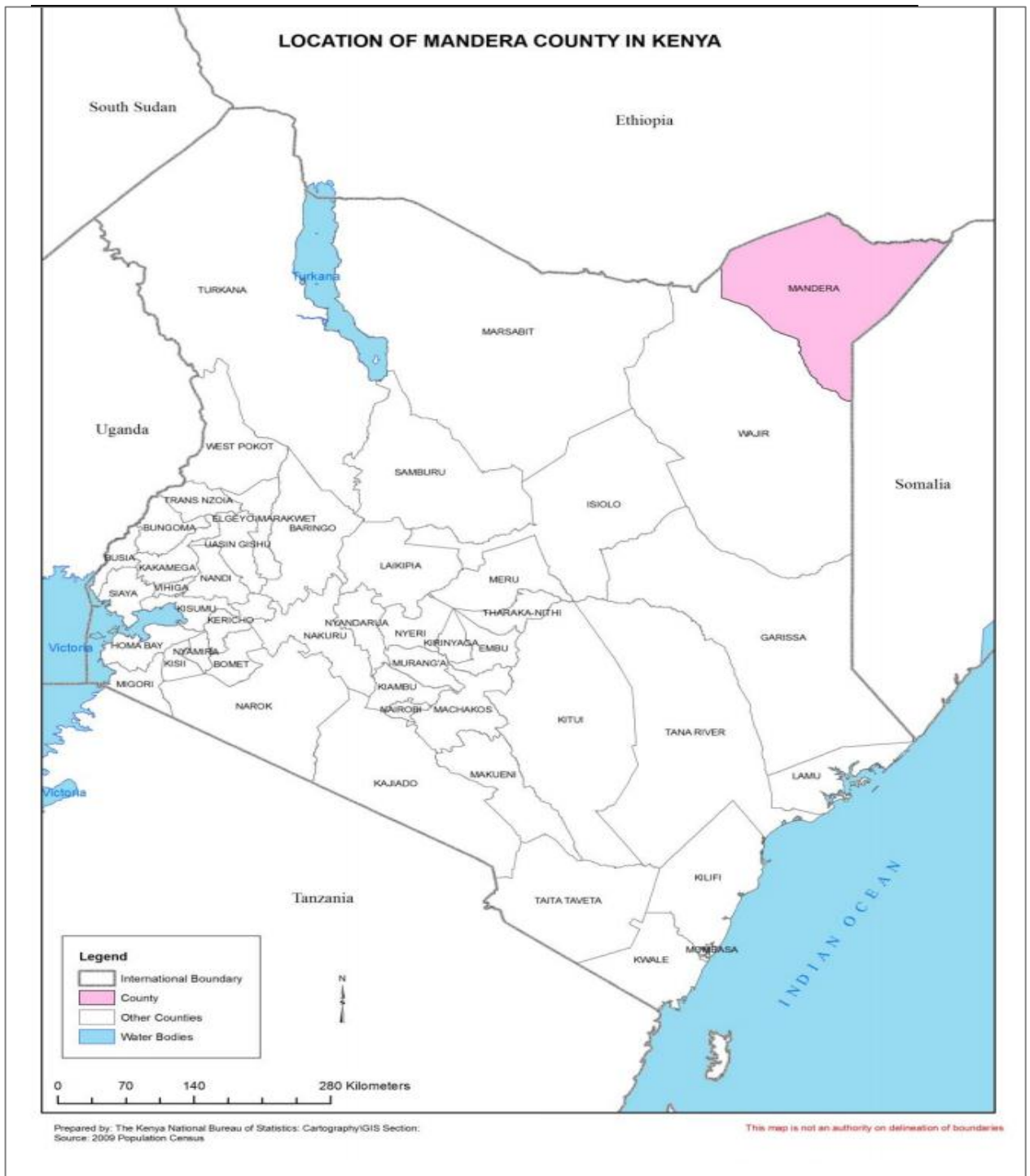


Figure 2: Map of the Republic of Kenya showing various county governments including Mander County.

Mandera County Referral Hospital is a level 4 hospital, located in Mandera town, the administrative base of the Mandera County Government. It serves the residents of Mandera town, referrals from the six sub county hospitals within the administrative boundaries of Mandera County, Gedo region of Somalia and the Ogden region of Ethiopia.

The maternity unit of the hospital has a bed capacity of eighty and one theatre bed for obstetrics emergencies. The average monthly deliveries are approximately 130, with an average of five deliveries per day. On average 15 cases of cesarean sections are performed per month. The hospital currently has a total of thirteen medical officers who perform the bulk of the caesarean sections.

The hospital has a fully functional records department, with seven health record information officers. Data generated from the departments are entered into the Hospital Information Record System (HIRS). The records department also stores in safe custody patient's files, as well analysis books from all departments within the hospital.

2.4 Source and study population

The source population was representative of all women who delivered at Mandera County Referral Hospital (MCRH) during the period under review, 1st January 2013 – 31st December 2017. The study population was representative of all women who underwent caesarean section at Mandera County Referral Hospital during the period under review.

2.5 Inclusion criteria

All caesarean sections (elective and emergency) performed at Mandera County Referral Hospital during the study duration.

2.6 Pretesting the checklist

Pilot survey and pretesting of the checklist was undertaken at Mandera County Referral Hospital in order to evaluate the comprehensive nature of the data obtained. Necessary adjustments were made before commencement of the data collection proper.

2.7 Training of the research assistants

Two research assistants were competitively recruited among the nurses stationed at the maternity unit, Mandera County Referral Hospital. A record clerk was also recruited to facilitate in the retrieval of files from the hospital records department. The teams were trained by the principal investigator on the purpose of the study, the need to adhere to the ethical principles and the scope of work to be undertaken by each member of the team.

2.8 Data collection

The entry point for the data collection was the maternity analysis book. Data on the total number of deliveries, as well as the total number of caesarean sections and the inpatient admission numbers of the individual patient's files who underwent CS were extracted. Data on caesarean sections obtained from the maternity analysis book were cross checked with the data in the theatre analysis book, as well the data in the hospital record and information system (HRIS) for completeness. The individual inpatient admission numbers of all the patients who underwent CS obtained from the maternity analysis books were used to retrieve the files from the hospital records department. Meticulous review of the data in the individual patient's file was undertaken by two research assistants. A structured checklist that had four strictly distinct sections namely, socio-demographic data, obstetric data, maternal outcomes and fetal outcomes. The main maternal variables collected were; age, gravidity, parity, gestational age, marital status, level of education, occupation, nature of admission and indications for caesarean section. Fetal variables of interest were Apgar score, birth weight and newborn unit admission.

2.9 Data management and analysis

Data entry template was made on the SPSS version 23.0, collected data were entered and checked for completeness. Analysis was done using the Statistical Package for Social Sciences (SPSS) version 23.0. Categorical variables (age, gravidity, parity, level of education, marital status, occupation, gestational age and nature of admission) were summarized using frequency and proportions. Linear trend of caesarean section rate, indications and fetomaternal outcomes over the five years duration was determined by Chi square using the statistical software EpiInfo, with a p-value of less than 0.05, considered to be statistically significant.

2.10 Ethical considerations

Ethical clearance was sought and obtained from the MUHAS Senate Research and Publication committee, as well as from the Kenya Medical Research Institute Scientific and Ethics Review Unit (KEMRI-SERU). At the county level clearance to conduct the research was sought and obtained from the Medical Superintendent in charge of Mandera County Referral Hospital, Mandera County, Kenya.

Data collected were coded and all patients' identifiers excluded to observe confidentiality.

CHAPTER THREE

3.0 RESULTS

During the period under review (2013-2017), the total numbers of deliveries were 7,613. Out of these, 6,830 (89.7%) were vaginal deliveries and 783 (10.3%) were caesarean sections. Out of 783 caesarean sections cases, 562 cases were analyzed. See **Figure 3**

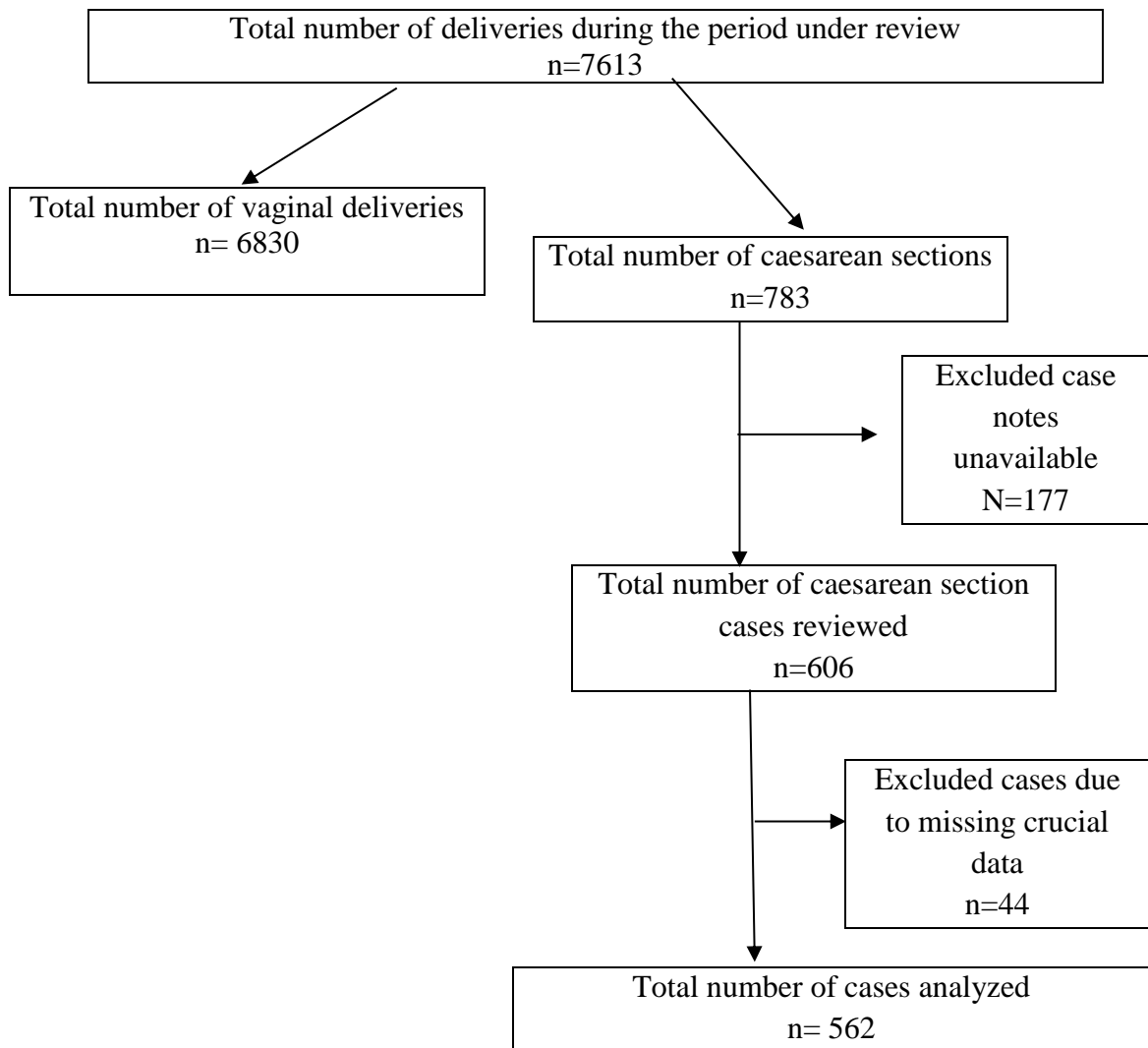


Figure 3: Study Flow Chart showing recruitment of the study participants

Table 1. Socio- demographic characteristics of the participants (n=562)

Variables	Frequency	Percentage (%)
Maternal age		
<20	112	19.9
20 -35	396	70.5
>35	54	9.6
Marital status		
Single	1	0.2
Married	561	99.8
Level of education		
No formal education	1	0.2
Primary education	2	0.4
Secondary education	1	0.2
Tertiary education	1	0.2
Missing information	557	99
Occupation		
Housewife	6	1.1
Employed	1	0.2
Missing information	555	98.8

More than two third (70.5%) of the participants were aged between 20 to 35 years and very few (9.6%) were aged more than 35 years. Majority of them were married at (99.8%) and only one person constituting 0.2% was single. Majority of the study participants had missing information about their level of education and occupation (99.0% and 98.8% respectively). See **Table 1**

Table 2. Obstetric characteristics of the participants (n=562)

Variables	Frequency	Percentage (%)
Gravidity		
1	205	36.5
2-5	225	40
>5	132	23.5
Gestational age		
<34	12	2.1
34-37	24	4.3
>37	526	93.6
Nature of labour onset		
Spontaneous	485	86.3
Induction	6	1.1
Prelabour CS	71	12.6
Nature of admission		
Self	295	52.5
Referral	267	47.5
Fetal presentation		
Cephalic	480	85.4
Breech	61	10.9
Others(transverse/oblique)	21	3.7
Level of urgency of CS		
Emergency	541	96.3
Elective	21	3.7
Type of Anesthesia		
Spinal	507	90.2
General	55	9.8
Abdominal incision		
Pfannenstiel	521	92.7
SUMI	41	7.3

CS: Caesarean Section, SUMI: Sub-umbilical Midline Incision

Four out of ten study participants (40%) were gravida 2 to 5. Majority of the participants (93.6%) had gestation age > 37 weeks, spontaneous labour was more frequent at (86.3%). About half (52.3%) of the study participants were admissions from home, cephalic presentation accounted for 85.4%. Majority (96.3%) had emergency cesarean section, spinal anaesthesia was used for (90.2%) of the participants. Pfannestiel incision was the most common abdominal incision at (92.7%). See **Table 2**

Table 3. Annual trends of vaginal deliveries and caesarean section rates, 2013-2017

Year	Vaginal deliveries (n= 6830)	Caesarean sections (n= 783)	Trend analysis
2013	965(88.2%)	129(11.8%)	$\chi^2 = 0.764, p = 0.382$
2014	1413(90.7%)	144(9.3%)	
2015	1425(89.4%)	169(10.6%)	
2016	1695(89.5%)	198(10.5%)	
2017	1332(90.3%)	143(9.7%)	

χ^2 : Chi Square for linear trend, p: p-value

The proportion of vaginal deliveries over the study duration ranged between (88.2% - 90.7%), while the caesarean section rate was lowest in 2014 being (9.3%) and highest in 2013 being (11.8%), P-trend over the five year was not statistically significant for the CS rate. See **Table 3** and **figure 4**

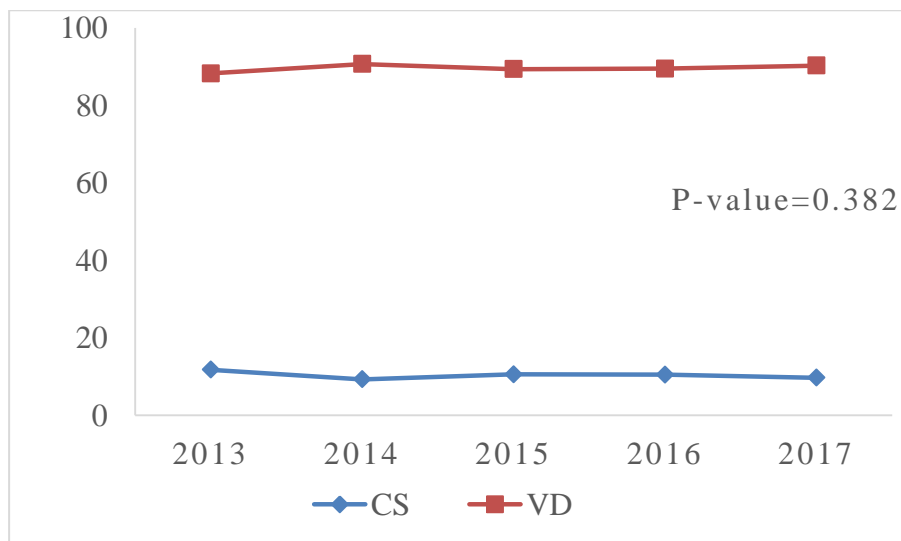


Figure 4: Trends in vaginal deliveries and caesarean section rate 2013 to 2017

Table 4. Cumulative Indications for caesarean section over the 5 years duration (n=562)

Variable	Elective CS	Emergency CS	Total CS
Previous caesarean section	13(2.3%)	120(21.4%)	133(23.7%)
Labour dystocia	NA	107(19%)	107(19%)
Obstructed labour	NA	96(17.1%)	96(17.1%)
Antepartum hemorrhage	1(0.2%)	72(12.8%)	73(13%)
Malpresentation	0	68(12.1%)	68(12.1%)
Fetal distress	NA	39(6.9%)	39(6.9%)
Others*	7(1.2%)	39(7%)	46(8.2%)

NA: Not applicable

Others: Eclampsia, Cord prolapse, Macrosomia, Multiple gestation, Elderly primigravida, Bad obstetric history, Failed induction and Huge perineal varicose veins.

During the 5 year period under the review, previous caesarean section was the most frequent indication for the index caesarean section accounting for 23.7%, in the descending order followed by; labour dystocia (19%), obstructed labour (17.1%), antepartum hemorrhage (13%), malpresentation (12.1%), fetal distress (6.9%) and other indications (8.2%). See **Table 4**

Table 5: Annual trends of the indications for caesarean sections (n=562)

Indications	Year					Trend analysis
	2013 n(%)	2014 n(%)	2015 n(%)	2016 n(%)	2017 n(%)	
Previous caesarean section	8 (18.6)	20 (23.8)	30 (20.8)	48 (27.6)	27 (23.1)	$\chi^2 = 0.649, p = 0.420$
Labour dystocia	7 (16.23)	16 (19.0)	21 (14.6)	38 (21.8)	25 (21.4)	$\chi^2 = 1.308, p = 0.253$
Obstructed labour	10 (23.3)	12 (14.3)	32 (22.2)	22 (12.6)	20 (17.1)	$\chi^2 = 1.004, p = 0.316$
Antepartum hemorrhage	6 (14.0)	10 (11.9)	20 (13.9)	27 (15.5)	10 (8.5)	$\chi^2 = 0.388, p = 0.534$
Malpresentation	6 (14.0)	10 (11.9)	19 (13.2)	18 (10.3)	15 (12.8)	$\chi^2 = 0.092, p = 0.762$
Fetal distress	4 (9.3)	5 (6.0)	7 (4.9)	11 (6.3)	12 (10.3)	$\chi^2 = 0.583, p = 0.445$
Others*	2 (4.7)	11 (13.1)	15 (10.4)	10 (5.7)	8 (6.8)	$\chi^2 = 1.198, p = 0.274$

χ^2 : Chi Square for linear trend, p-value

Others: Eclampsia, Cord prolapse, Macrosomia, Multiple gestation, Elderly primigravida,

Bad obstetric history, Failed induction and Huge perineal varicose veins.

Previous caesarean section was least indicated in 2013 at (18.6%) and highly indicated in 2016 for (27.6%), obstructed labour was least indicated in 2016 for (12.6%) and highly indicated in 2013 for (23.3%), labour dystocia was least indicated in 2015 for (14.6%) and highly indicated in 2016 for (21.8%), antepartum hemorrhage was least indicated in 2017 for 8.5% and highly indicated in 2016 for (15.5%) and fetal distress was least indicated for caesarean section in two consecutive years of 2014 and 2015 for (6.0%) and (4.9%) respectively and was highly indicated in 2013 and 2017 for (9.3%) and (10.3%) respectively. P-trend for caesarean section indications was not statistically significant over the 5 year period under review. See **Table 5** and **Figure 4**

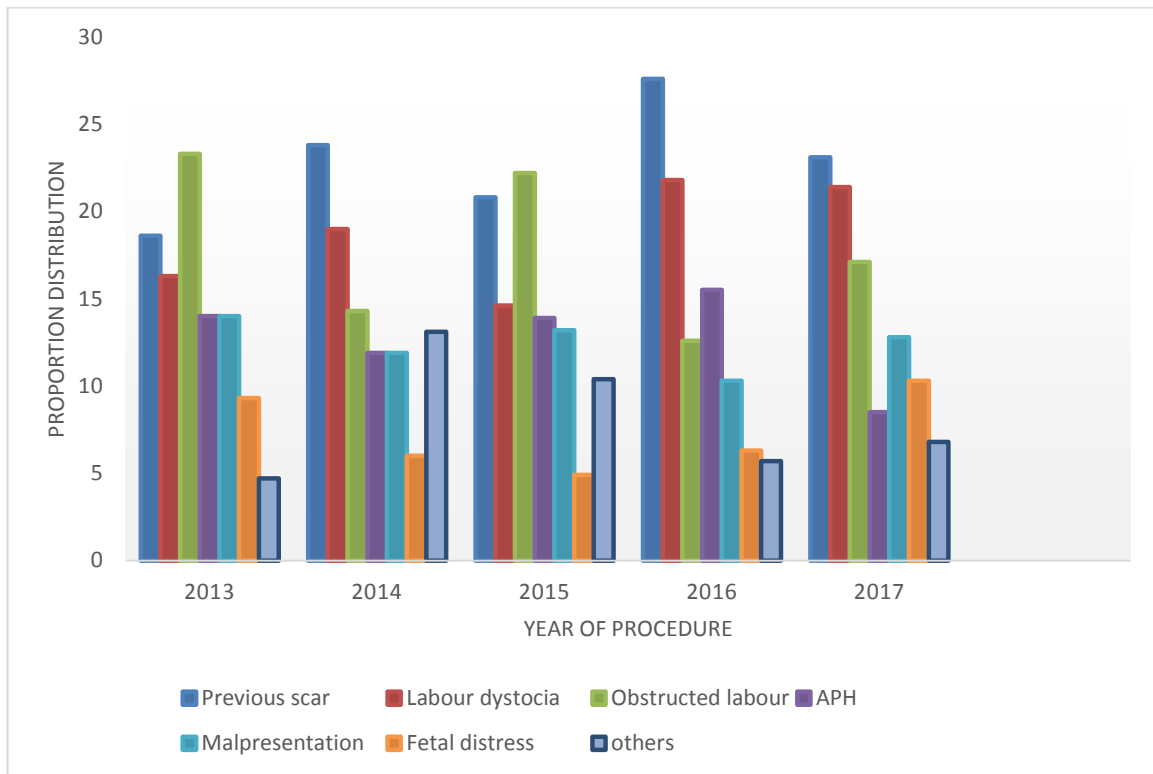


Figure 5: Graphical presentation of Annual trends of caesarean section indications

Table 6. Annual trends of fetal outcomes of caesarean sections, 2013-2017(n=589)

Variables	2013	2014	2015	2016	2017	Total	Trend analysis
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Fetal outcomes							
Live births	38(84.4)	74(85.1)	136(89.5)	158(87.7)	110(88.0)	516(87.6)	$\chi^2 = 0.443$, p = 0.506
Still birth fresh	6 (13.3)	11(12.6)	13(8.5)	19(10.6)	14(11.2)	63(10.7)	$\chi^2 = 0.117$, p = 0.733
Still birth macerated	1(2.2)	2 (2.3)	3(2.0)	3(1.7)	1(0.8)	10(1.7)	$\chi^2 = 0.775$, p = 0.379
Fetal weight							
< 1500	0(0.0)	0(0.0)	5(3.3)	3(1.7)	2(1.6)	10(1.7)	$\chi^2 = 0.522$, p = 0.470
1500-2499	7(15.6)	6(6.9)	11(7.2)	8(4.4)	10(8.0)	42(7.1)	$\chi^2 = 1.813$, p = 0.178
2500-3999	34 (75.6)	76(87.4)	125(82.2)	157(87.2)	105(84.0)	497(84.4)	$\chi^2 = 0.818$, p = 0.366
≥4000	4(8.8)	5 (5.7)	11(7.2)	12 (6.7)	8 (6.4)	40(6.8)	$\chi^2 = 0.090$, p = 0.765
Apgar score							
< 7	3(7.9)	8(10.8)	23(16.9)	12(7.6)	10(9.1)	56(10.9)	$\chi^2 = 0.649$, p = 0.421
≥ 7	35(92.1)	66(89.2)	113(83.1)	146(92.4)	100(90.9)	460(89.1)	
Admission to NBU							
Yes	3 (7.9)	11 (14.9)	23(16.9)	14(8.9)	17(15.5)	68(13.2)	$\chi^2 = 0.011$, p = 0.917
No	35(92.1)	63(85.1)	113(83.1)	144(91.1)	93(84.5)	448(86.8)	
Early neonatal death							
Yes	1 (2.6)	6(8.1)	16(11.8)	9(5.7)	8 (7.3)	40(7.8)	$\chi^2 = 0.009$, p = 0.925
No	37(97.4)	68(91.9)	120(88.2)	149(94.3)	102(92.7)	476(92.2)	

χ^2 : Chi Square for linear trend , p: P-value, NBU: New born unit admission

During the period under review (2013-2017), CS had varying proportions of live births ranging from 84.4% to 89.5%, the highest proportion of still birth fresh were documented in the year 2013 at 13.3%. Majority of the neonates had birth weight ranging from 2500-3999 grams, the highest proportions of neonates with APGAR score < 7, admission to NBU and early neonatal deaths were documented in 2015, ranging from 11.8% to 16.9%. P-trend for fetal outcomes over the five year duration was not statistically significant. See **Table 6**

Table 7: Annual trend of maternal outcomes in caesarean sections, 2013-2017 (n=562)

Variables	2013	2014	2015	2016	2017	Total	Trend analysis
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Blood transfusion							
Yes	19(44.2)	37(44.0)	55(38.2)	58(33.3)	33(28.2)	202(35.9)	$\chi^2=7.263$, p =0.007**
No	24(55.8)	47(56.0)	89(61.8)	116(66.7)	84(71.8)	360(64.1)	
Intraoperative complications							
Bladder injury	1(2.3)	0(0.0)	1(0.7)	0(0.0)	0(0.0)	2(0.4)	$\chi^2=1.569$, p =0.210
Uterine rupture	1(2.3)	3(3.6)	2(1.4)	3(1.7)	3(2.6)	12(2.1)	$\chi^2 =0.939$, p =0.333
Extension of the uterine incision	0(0.0)	1(0.7)	1(0.7)	2(1.1)	0(0.0)	4(0.7)	$\chi^2 =0.070$,p =0.791
Anesthesia complications	1(2.3)	0(0.0)	1(0.7)	1(0.6)	0(0.0)	3(0.5)	$\chi^2 =0.380$,p =0.537
Postoperative complications							
Wound dehiscence	2(4.7)	1(1.2)	7(4.9)	3(1.7)	2(1.7)	15(2.7)	$\chi^2 =0.412$, p =0.521
Burst abdomen	0(0.0)	0(0.0)	0(0.0)	1(0.6)	0(0.0)	1(0.2)	$\chi^2 =0.356$,p =0.551
Puerperal sepsis	0(0.0)	0(0.0)	2(1.4)	0(0.0)	2(1.7)	4(0.7)	$\chi^2 =1.575$, p =0.209
Maternal death	2(4.7)	1(1.2)	4(2.8)	3(1.7)	2(1.7)	12(2.1)	$\chi^2 =0.168$,p =0.682
Duration of hospitalization							
>7days	2(4.7)	1(1.2)	13(9.0)	9(5.2)	6(5.1)	31(5.5)	$\chi^2 =0.198$,p =0.656
≤ 7days	41(95.3)	83(98.8)	131(91.0)	165(94.8)	111(94.9)	531(94.5)	

χ^2 : Chi Square for linear trend, p : P-value, ** statistically significant difference

Blood transfusion was the most frequent adverse maternal outcome, documented in varying proportions ranging from 28.2% to 44.2%, uterine rupture (2.1%) and wound dehiscence (2.7%) were the most common intraoperative and post-operative complications. Prolonged hospital stay > 7days, most frequently documented in the year 2015 at 9%. P- Trend was significant for blood transfusion over the study duration with p-value < 0.05. See **Table 7**

CHAPTER FOUR

4.0 DISCUSSION AND LIMITATIONS

4.1 Discussion

Worldwide the trend in caesarean section has been on the upsurge, situation analysis in sub-Saharan Africa calls for focused attention due to the higher than average increased rate of maternal and perinatal morbidity and mortality. In this hospital-based study the average CS rate over the study duration was (10.3%), emergency CS (96.3%) were more frequent than elective CS (3.7%). The most common indication for CS during the period under review was previous caesarean section at (23.7%). The dominant adverse fetomaternal outcomes were newborn unit admission (13.2%) and blood transfusion (35.9%). Case fatality rate for CS over the study duration stands at (2.1%). Trend analysis over the study duration was only significant for blood transfusion with p-value less than 0.05.

In this hospital-based study there has been little change in the proportions of caesarean section from 2013 to 2017. With the percentages ranging from 9.3% to 11.8%, this is slightly higher than Kenya's country specific average caesarean section rate of 8.7% and ten times higher than Mandera county's caesarean section rate of 1.8% as per the Kenya Demographic Health Survey (KDHS 2014) (22). Hospital-based caesarean section rate at Mandera County Referral Hospital, Kenya was lower than the global average CS rate of 26.4%, 31.2% and 18.6% respectively for WHO global survey of maternal and perinatal health (WHOGS, 2004-2008), WHO multi-country survey of maternal and newborn health (WHOMCS, 2010-2011) and The Global, Regional and National Estimates (1990-2014)(11,13,14).

Hospital-based caesarean section rate at Mandera County Referral Hospital, Kenya, slightly higher than the countries specific CS rates among the East African countries of Tanzania (6%), Uganda (6.2%) and Kenya (8.7%), based on the latest country specific demographic health surveys (16,22,32). The variation above can be attributed to the fact that Mandera County Referral Hospital is the main referral facility within the county, thus receives referral cases from all the six sub counties, as well as cross border referrals from Ethiopia and Somalia due to strategic location of Mandera town. The above hypothesis

supported by the fact that 47.5% of study participants who underwent CS during the period under review were referral cases.

The average caesarean section rate at MCRH stands at 10.3%, which is on average three times lower than the hospital-based CS rate in various hospitals within the East African region; The Aga Khan University Hospital, Kenya (38.1%), Kilimanjaro Christian Medical Centre, Tanzania (35.5%), Kenyatta National Hospital (28.5%) and the Nairobi Hospital (28.3%) (19,23,24). The findings above can be explained by the geographical location, socioeconomic and demographic characteristics of the populations served by the different hospitals.

The bulk of the caesarean sections performed during the period under review were emergency CS comprising 96.3% of all the total caesarean sections. This finding is consistent with the findings from studies in other countries such as Nigeria (74.6%) and Ethiopia (90.4%) (4,33). Available data shows that most women undergo emergency CS than elective CS, majority of the patients who undergo emergency CS are either referral from other health facilities or self-referral from home after unsuccessful home delivery. A considerable proportion of emergency CS also originate within a hospital setting, due the numerous feto-maternal indications made in a woman who is in labour due to various obstetric complications. This study also established that majority of the patients who underwent CS during the period under review had spontaneous labour onset at the time of admission at (86.3%), as well the fact that half of the cases reviewed were referral from various health facilities within Mandera County, Kenya and the neighboring countries of Somalia and Ethiopia.

Maternal indications; antepartum hemorrhage, obstructed labour, labour dystocia and previous caesarean sections, were the most common indications for caesarean section in our study, with wide variations in proportions ranging from (13%) to (23.7%). The main fetal indications for caesarean section were malpresentation and fetal distress. Similar findings were obtained in other studies (13,19). The most frequent indication for caesarean section during the period under review was previous caesarean section with a varying range in proportion from (18.6%) to (27.6%), finding consistent with numerous other studies done in developed and developing countries (26,34,35). Previous caesarean section

dominance among the indications can be attributed to the increasing number of primary CS, which in turn increases the rate of repeat caesarean section. Lower rates of trial of labour after caesarean section (TOLAC) in low resource countries also results in increased cases of repeat CS, this attributed to lack of adequate human resource and equipment for intrapartum maternal and fetal monitoring.

Varying proportions of adverse fetomaternal outcomes were documented over the study duration. The main adverse fetal outcomes were in the descending order; new born unit admission (13.2%), APGAR score < 7(10.9%), still birth fresh (10.7%), early neonatal death (7.8%) and still birth macerated (1.8%). Similar findings were observed in a hospital based study in Ghana by James et al, which showed the need for ICU admission as the most frequent adverse fetal outcome (1.9%), followed by fresh stillbirth (1.2%) and macerated still birth (1.1%). The dominant adverse maternal outcome over the study duration was blood transfusion at (35.9%), other maternal adverse outcomes were; prolonged hospital stay >7days (5.5%), wound dehiscence (2.7%), uterine rupture (2.1%), maternal death (2.1%) extension of the uterine incision (0.7%), puerperal sepsis (0.7%) anesthesia complications (0.5%), bladder injury (0.4%), and burst abdomen (0.2%). The study findings on both fetal and maternal outcomes were significantly higher compared with other studies (27,34). These findings can be explained by the high proportions of emergency caesarean sections (96.3%) than elective caesarean section (3.7%) in our study. Emergency caesarean sections are associated with greater incidence of adverse fetomaternal outcomes. Mander County also has grim statistics in terms of maternity mortality and neonatal mortality at 3,795 per 100,000 and 24 per 1,000 live births.

4.2 Study limitations and mitigations

During the data collection and analysis stage several crucial data, pertaining to socio-demographic characteristics, particularly level of education and occupation of the participants were not documented within the patients files. A number of patient's files (177), were not traced during data collection, thus excluded from the study. Some files (44) had procedure notes missing thus also excluded from the study.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The average hospital-based caesarean section rate at Mandera County Referral Hospital, Mandera County, Kenya, over the study period under review stands at 10.3%. The dominant indication for CS was previous caesarean section at 23.7%. The key findings of the study were the high frequency of adverse fetomaternal outcomes among caesarean sections performed at Mandera County Referral Hospital over the study duration.

5.2 Recommendations

Elective caesarean section rate is low in our study compared with other similar hospital-based studies, this would depict that there were cases which missed elective delivery plan from antenatal care and ended up undergoing delivery under emergency settings. Thus, measures should be instituted at MCRH to provide elective caesarean section to the recommended patients.

Further study be undertaken to determine predictors of adverse fetomaternal outcomes among patients who undergo caesarean section at Mandera County Referral Hospital.

Key socio-demographic variables were not captured during the patient admission thus the hospital management with support from the county department of health services should sensitize the health workers and implement measures to ensure that all relevant biographic details are collected upon patient admission.

Audit of the health records and management system at Mandera County Referral Hospital should be undertaken due to the large number of patients file related to our study could not be traced. This in turn will lead to identification of gaps and implementation of measures to improve general hospital based record keeping.

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APPENDIXES

APPENDIX I: CHECKLIST

Proposal title: Annual trends of caesarean section rates, indications, fetal and maternal outcomes at Mandera County Referral Hospital, Mandera County Kenya.

Participant's registration number	
Year	

Section A: socio- demographic variables	
I. Maternal age	
1) < 20	<input type="text"/>
2) 20-35	<input type="text"/>
3) >35	<input type="text"/>
II. Gravidity	
1) Primigravida	<input type="text"/>
2) 2-5	<input type="text"/>
3) >5	<input type="text"/>
III. Gestational age	
1) <34	<input type="text"/>
2) 34-37	<input type="text"/>
3) >37	<input type="text"/>
IV. Marital status	
a) Single	<input type="text"/>
b) Married	<input type="text"/>
c) Widowed	<input type="text"/>
d) Divorced	<input type="text"/>
V. Level of education	
a) 0	<input type="text"/>
b) 1-8	<input type="text"/>
c) 8-12	<input type="text"/>
d) >12	<input type="text"/>
VI. Occupation	
a) Housewife	<input type="text"/>
b) Business women	<input type="text"/>
c) Employed	<input type="text"/>
d) Student	<input type="text"/>
VII. Nature of admission	
a) Self	<input type="text"/>
b) Referral	<input type="text"/>

Obstetric Data	
1. Mode of delivery for previous pregnancies, if applicable? a) Vaginal b) Caesarean section c) Vaginal plus caesarean section	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
2. From the records, how was the labour onset a) Spontaneous b) Induced c) No labour (prelabour caesarean section)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
3. What was the documented fetal presentation a) Cephalic b) Breech c) Others(transverse/oblique)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
4. What was the documented indication for caesarean section? a) Prior caesarean section b) Labour dystocia c) Antepartum haemorrhage d) Fetal distress e) Malpresentation f) Obstructed labour g) Others.....	
5. What was the documented level of urgency of the procedure? a) Emergency caesarean section b) Elective caesarean section	<input type="checkbox"/> <input type="checkbox"/>
6. What was the documented type of anesthesia under which the procedure was performed? a) Spinal anesthesia b) General anesthesia c) Other.....	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

<p>7. What was the documented skin incision</p> <p>a) Pfannenstiel incision</p> <p>b) sub-umbilical midline incision(SUMI)</p>	<table border="1"> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>					
<p>8. Was there any documented Intraoperative or postoperative blood transfusion</p> <p>a) Yes</p> <p>b) No</p>	<table border="1"> <tr><td></td></tr> <tr><td></td></tr> </table>					
<p>9. What were the documented Intraoperative findings and complications</p> <p>a) None</p> <p>b) Bladder injury</p> <p>c) Uterine rupture</p> <p>d) Extension of the uterine incision</p> <p>e) Others</p>	<table border="1"> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>					
<p>10. Where there any documented post-operative complications.</p> <p>a) None</p> <p>b) Wound dehiscence</p> <p>c) Burst abdomen</p> <p>d) Puerperal sepsis</p> <p>e) Others.....</p>	<table border="1"> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> </table>					
<p>11. What was the average length of hospital stay post procedure?</p> <p>a) < 7 days</p> <p>b) > 7days</p>	<table border="1"> <tr><td></td></tr> <tr><td></td></tr> </table>					

Fetal outcomes	
12. From the records how many neonates were extracted during caesarean section a) Single b) Multiple	<input type="text"/> <input type="text"/>
13. What was the documented fetal outcome of the procedure a) Live birth b) Spontaneous birth fresh (SBF) c) Spontaneous birth macerated (SBM)	<input type="text"/> <input type="text"/> <input type="text"/>
14. What was the documented fetal weight at the time of delivery a) < 1500g b) 1500-2499g c) 2500-3999g d) >4000g	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
15. What was the documented APGAR score at 5 minutes a) < 7 b) >7	<input type="text"/> <input type="text"/>
16. Any documentation on neonatal admission to new born unit a) Yes b) No	<input type="text"/> <input type="text"/>

APPENDIX II: LETTER OF ETHICAL CLEARANCE "I"

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Ref. No. DA.287/298/01A/

13th August, 2018

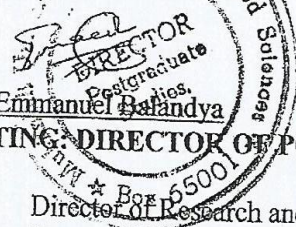
Dr. Kala Hassan Adan
 MMed. Obstetrics and Gynaecology
MUHAS.

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED: "ANNUAL TRENDS OF CAESAREAN SECTION RATES, INDICATIONS, FETAL AND MATERNAL OUTCOME AT MANDERA COUNTY REFERRAL HOSPITAL, MANDERA COUNTY KENYA"

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has, on behalf of the Senate, approved ethical clearance for the above-mentioned study. Hence you may proceed with the planned study.

The ethical clearance is valid for one year only, from 28th June, 2018 to 27th June, 2019. In case you do not complete data analysis and dissertation report writing by 27th June, 2019, you will have to apply for renewal of ethical clearance prior to the expiry date.


 DIRECTOR
 Postgraduate
 Studies,
 Muhimbili University of Health and Allied Sciences
 P.O. Box 65001
 Dar es Salaam, Tanzania

ACTING DIRECTOR OF POSTGRADUATE STUDIES

cc: Director of Research and Publications
 cc: Dean, School of Medicine

APPENDIX III: LETTER OF INTRODUCTION

**MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES**

P.O. Box 65001
DAR ES SALAAM
TANZANIA
Web: www.muhas.ac.tz



Tel G/Line: +255-22-2150302/6 Ext. 1015
Direct Line: +255-22-2151378
Telefax: +255-22-2150465
E-mail: dpgs@muhas.ac.tz

Ref. No. HD/MUH/K.119/2016

14th August, 2018

Medical Superintendent
Mandera County Referral Hospital
P.O. Box 13 -70300
MANDERA.

Re: INTRODUCTION LETTER

The bearer of this letter Dr. Kala Hassan Adan is a student at Muhimbili University of Health and Allied Sciences (MUHAS) who is pursuing MMed. Obstetrics and Gynaecology.

As part of his studies he intends to do a study titled: "*Annual trends of caesarean section rates, inductions, fetal and maternal outcome at Mandera County referral hospital, Mandera County Kenya*".

The research has been approved by the Chairman of University Senate.

Kindly provide him the necessary assistance to facilitate the conduct of his research.

We thank you for your cooperation.

Ms. L.G. Kapama

For: DIRECTOR, POSTGRADUATE STUDIES

cc: Dean, School of Medicine.
cc: Dr. Kala Hassan Adan



APPENDIX IV: LETTER OF ETHICAL CLEARANCE "II"



KENYA MEDICAL RESEARCH INSTITUTE

P.O. Box 54840-00200, NAIROBI, Kenya
 Tel: (254) (020) 2722541, 2713349, 0722-205901, 0733-400003, Fax: (254) (020) 2720030
 E-mail: director@kemri.org, info@kemri.org, Website: www.kemri.org

KEMRI/RES/7/3/1

December 19, 2018

**TO: DR. KALA HASSAN ADAN (PRINCIPAL INVESTIGATOR)
 MUHUMBILI UNIVERSITY,
 TANZANIA.**

Dear Sir,

**RE: NON-KEMRI 640 (RESUBMISSION II OF INITIAL SUBMISSION):
 ANNUAL TRENDS OF CAESAREAN SECTION RATES, INDICATIONS,
 FETAL AND MATERNAL OUTCOMES AT MANDERA COUNTY REFERRAL
 HOSPITAL, MANDERA COUNTY KENYA**

Reference is made to your letter December 14, 2018. The KEMRI/Scientific and Ethics Review Unit (SERU) acknowledges receipt of the revised study documents on December 17, 2018.

This is to inform you that the Committee notes that the following issues raised during the 279th Committee C meeting of the KEMRI Scientific Ethics Review Unit (SERU) held on **September 27, 2018** have been adequately addressed.

Consequently, the study is **granted approval** for implementation effective this day, **December 19, 2018** for a period of one year. Please note that authorization to conduct this study will automatically expire on **December 18, 2019**. If you plan to continue data collection or analysis beyond this date, please submit an application for continuation approval by **November 06, 2019**.

You are required to submit any proposed changes to this study to SERU for review and the changes should not be initiated until a written approval from SERU is received. Please note that any unanticipated problems resulting from the implementation of this study should be brought to the attention of SERU and you should advise SERU when the study is completed or discontinued

Yours faithfully,

**ENOCK KEBENEI
 THE ACTING HEAD
 KEMRI SCIENTIFIC AND ETHICS REVIEW UNIT**

APPENDIX V: LETTER OF PERMISSION FOR DATA COLLECTION



REPUBLIC OF KENYA
 THE COUNTY GOVERNMENT OF MANDERA
 DEPARTMENT OF HEALTH SERVICES
 MANDERA COUNTY REFERRAL HOSPITAL
 P.O.BOX 13-70300, MANDERA
 Email: manderahospital@gmail.com



REF: MCRH/GEN/21/12/18

21ST DECEMBER, 2018

TO:

THE DIRECTOR, POSTGRADUATE STUDIES
 MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
 P.O BOX 65001
 DAR ES SALAAM
 TANZANIA

Dear Sir/Madam

RE: PERMISSION FOR DATA COLLECTION

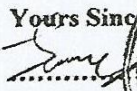
In reference to the letter dated 14th August, 2018, Ref. No. HD/MUH/K.119/2016.

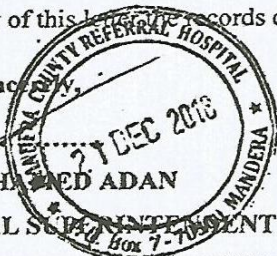
I hereby convey that permission has been granted to Dr. Kala Hassan Adan a student at Muhimbili University of Health and Allied Sciences (MUHAS) to collect data in reference to the study titled: *"Annual trends of caesarean section rates, indications, fetal and maternal outcomes at Mandera County Referral Hospital, Mandera East Sub-county, Mandera County, Kenya, 2013 – 2017"*

The principal investigator is mandated to strictly adhere to all ethical principles at all times during the data collection period.

By a copy of this letter, the records department is advised to facilitate.

Yours Sincerely,


 DR. MOHAMED ADAN
 MEDICAL SUPERINTENDENT
 MANDERA COUNTY REFERRAL HOSPITAL



CC: Dean, School of Medicine (MUHAS)

CC: In charge Health Records Information Officer (MCRH)