CLINICAL OFFICERS IN MALAWI: EXPANDING ACCESS TO COMPREHENSIVE EMERGENCY OBSTETRIC CARE.

BY

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DECLARATION

I GARVEY CHIPILIRO CHILOPORA hereby declare that the work on which this dissertation is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

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Abstract

Background: Clinical officers perform much of major emergency surgery in Malawi, in the absence of medical officers. The aim of this study was to validate the advantages and disadvantages of delegation of major obstetric surgery to non-doctors.

Methods: During a three month period, data from 2131 consecutive obstetric surgeries in 38 district hospitals in Malawi were collected prospectively. The interventions included caesarean sections alone and those that were combined with other interventions such as subtotal and total hysterectomy repair of uterine rupture and tubal ligation. All these surgeries were conducted either by clinical officers or by medical officers.

Results: During the study period, clinical officers performed 90% of all standard caesarean sections, 70% of those combined with subtotal hysterectomy, 60% of those combined with total hysterectomy and 89% of those combined with repair of uterine rupture. A comparable profile of patients was operated on by clinical officers and medical officers, respectively. Postoperative outcomes were almost identical in the two groups in terms of maternal general condition – both immediately and 24 hours postoperatively – and regarding occurrence of pyrexia, wound infection, wound dehiscence, need for re-operation, neonatal outcome or maternal death.

Conclusion: Clinical officers perform the bulk of emergency obstetric operations, including complicated procedures, at district (level 1) hospitals in Malawi. The postoperative outcomes of their procedures are comparable to those of medical officers. Clinical officers constitute a crucial component of the health care team in Malawi for saving maternal and neonatal lives given the scarcity of physicians.

Chapter 1

Introduction

Malawi, like many other countries in sub Saharan Africa is facing a critical shortage of human resources across all cadres in the health sector. The Ministry of Health declared this shortage a crisis in early 2004 [1]. With the help of donor funds, the government embarked on a six year Emergency Human Resource Programme aimed at improving staff recruitment and retention in the public sector [1, 2].

Due to the high cost of training medical doctors and other health personnel, the country has been faced with a chronic underproduction of health care personnel. At 0.022 per 1000 population the present physician density is one of the world's lowest [3].

HIV/AIDS has also taken a significant toll on health care providers. An initial Human Resources Development Plan 1999 to 2004 assumed an annual HIV/AIDS related attrition of 2.8% [4]. However this is thought to be an underestimate. In addition to AIDS related deaths, health personnel have left the profession for other less risky professions for fear of being exposed to the disease. A lot of staff time has also been lost through prolonged periods of illness, funeral attendance as well as taking care of sick relatives
[2, 5].

The migration of health professionals, notably doctors and nurses to high income countries has also made a large contribution to the worsening human resource

situation in countries that can least afford the brain drain including Malawi [5]. However, this raises conflict between the individual's right to travel and the country's need for an adequate health workforce [6].

Against this background, Malawi has to live up to the challenge of meeting the Millennium Development Goal (MDG) number 5 i.e. to reduce maternal mortality by 75% by 2015. Success stories from Sri Lanka and Malaysia point to human resources as a crucial factor in reducing maternal mortality [7, 8**].** In order to cope with the ever-increasing demand for health care workers, the Ministry of Health in Malawi introduced a cadre of midlevel health care providers called Clinical Officers as early as 1976. These are non doctors trained locally for three years. After completing a year of internship either at the central or district hospital, they (like medical graduates) are licensed to practice independently and perform major emergency surgery.

Clinical officers have contributed significantly to the provision of comprehensive emergency obstetric care in Malawi at both district and central hospital level. In a review by Fenton et al (1997), the majority of caesarean sections at these hospitals were performed by clinical officers [9]. They make up the bulk of the clinical care team.

Unlike in Tanzania and Mozambique, the delegation of medical work to non doctors has not been scientifically validated in Malawi [10, 11, 12]. This is the motivation for the current study.

Chapter 2

Literature Review

Van Lerberghe and De Brouwere (1998) noted that maternal mortality decreased in Northern Europe due to effectiveness of skilled birth attendants between 1870 and 1900 [13]. More importantly, a further decrease occurred over a 30 year period from 1937 as a result of a series of medical advances including safer caesarean section [14, 15]. Okonofua (2001) suggests that the low rate of caesarean section for the management of obstetric complications may be an important factor associated with high rates of maternal morbidity and mortality in West Africa [16]. The confidential enquiry into institutional maternal deaths in the Southern Region of Malawi in 2001 noted that 23.9% of the direct maternal deaths were due to ruptured uterus and obstructed labour [17]. It is now recognised that caesarean section is an important lifesaving procedure for both the mother and the baby to prevent obstructive obstetric complications [18].

This life saving procedure, like all other surgical procedures is not without complications. Such complications can be immediate or long term and may impact on both the mother and the newborn.

Intra-operative maternal complications include the risk of haemorrhage and injury to other pelvic organs such as the bladder, bowel and ureters. This risk is increased in women with previous pelvic surgery. According to the confidential enquiry into maternal deaths in South Africa during the triennium 2002 to 2004, obstetric haemorrhage was the second most common direct cause of maternal death accounting

for 13.4% of deaths. This includes both antepartum and postpartum haemorrhage (PPH). Haemorrhage during or after caesarean section as a result of atony of the uterus, uterine tears and other problems with achieving haemostasis contributed significantly to this figure, accounting for over 25% of all deaths in the PPH category [19].

Immediate maternal complications include abdominal pain which may make the establishment of breast feeding difficult. Women are also advised not to perform such activities as driving for at least 6 weeks post delivery and this may impact heavily on their working or social life.

Wound sepsis and pelvic infection is a well known complication of caesarean section. This is more common for emergency caesarean sections, particularly when performed for prolonged or obstructed labour. This problem is compounded by infection with HIV. In a study by Grubert et al (1999), higher rates of septic complications after abdominal surgery were found in HIV positive women. Antiretroviral therapy and standard peri-operative antibiotic prophylaxis did not decrease the risk of complications [20].

Anaesthesia related complications are the sixth leading cause of pregnancy related death in the United States of America. Most complications occur during general anaesthesia for caesarean section. A 1979 to 1990 audit in the USA showed that deaths due to general anaesthesia remained stable in number and contribute most to the total deaths. Spinal and epidural anaesthesia have lesser risk than general anaesthesia. Heightened awareness of toxicity of local anaesthetics and related

improvements in technique might have contributed to a reduction in complications of regional anaesthesia [21].

Thromboembolic disease is a single leading cause of maternal morbidity and mortality in the United Kingdom. In the triennial report on the Confidential Enquiry into Maternal and Child Health in the United Kingdom 2003– 2005, operative delivery, particularly emergency procedures during labour, was identified as one of the risk factors for maternal death from this complication. Other risk factors included previous thromboembolism, advanced maternal age, obesity and immobilization [22, 23]. In a study in Scotland between 1983 and 1992, the risk of thromboembolism after caesarean delivery was 3 times higher than that following a normal vaginal delivery [24].

Perhaps the most feared of all complications of caesarean section is the risk of rupture of the uterus in subsequent pregnancies. A 10 year retrospective study from 1988 to 1997 in the province of Nova Scotia, Canada found that there were 39 cases of ruptured uterus out of 114,933 deliveries. Ninety two percent of the cases of ruptured uterus were associated with a previous caesarean section [25]. In Malawi the incidence may be much higher due to poor access to health care as well as the lack of human resources for health.

Caesarean section is associated with greater maternal mortality than vaginal delivery with emergency surgery more likely to cause mortality than elective procedures [26]. In considering mortality associated with caesarean section, it is important to distinguish those deaths which are due to the underlying condition such as eclampsia,

from direct complications of the surgery.

Babies born by caesarean section have been observed to have an increased incidence of respiratory problems. These are encountered in 35 out of 1000 caesarean section deliveries as opposed to 5 out of 1000 normal vaginal deliveries. The risk of respiratory problems diminishes with increasing gestational age. In a large prospective survey in the United Kingdom, the incidence of respiratory morbidity in newborns at term decreased from 42.3 per 1000 at 38 weeks to 17.8 per 1000 at 39 weeks gestation. The National Institute for Clinical Excellence (NICE) in the United Kingdom therefore recommends that elective caesarean section should not be routinely carried out before 39 weeks gestation [27].

There is debate as to whether caesarean section increases the risk of unexplained stillbirth in subsequent pregnancies. In a study by Gordon et al (2003), the absolute risk of unexplained stillbirth from 39 weeks and beyond was 1.06 per 1000 in women with previous caesarean section and 0.47 per 1000 in other women [28]. However, more recent study by Wood et al (2008) refutes this finding [29]. This is important information for women with previous caesarean section who require advice about mode of delivery in subsequent pregnancy. It is also important to advise women requesting caesarean section without any obstetric indication.

Immediate skin to skin contact between the mother and her baby post delivery is important in facilitating bonding between them. Caesarean delivery may not allow this to happen because often the mother is tired and in pain and is usually not in a position to take care of the new born. Intra-operatively, the fetus may sustain

lacerations while the surgeon is opening the uterus. The incidence of such injury is 1.4% in vertex presentations and may be as high as 6.0% in non vertex presentations [30].

In the United Kingdom, according to the National Sentinel caesarean section Audit report 2001, a specialist registrar, year 1 – 3, is the most senior person in theatre during most of the caesarean sections. It is recommended that a consultant be present for at least 10% of potentially complicated caesarean sections. These potentially complicated caesarean sections include placenta previa, placenta abruption, full cervical dilatation, obese women, premature deliveries less than 32 weeks, multiple pregnancy and women who have had multiple previous caesarean sections [31].

Due to the scarcity of doctors, some countries have chosen to train mid level cadres to provide medical and emergency surgical care including anaesthesia. These midlevel health care providers also provide preventive and non emergency primary care. Mozambique initiated the training of "tecnicos de cirurgia" in the early 1980s. This training has some similarities to the training of clinical officers in Malawi as well as the training of assistant medical officers in Tanzania. Despite the presumed success of such programs, there is very little literature regarding the scientific assessment of the quality of care provided by these midlevel cadres.

In Mozambique, two studies have been published. The first study comprised 2,071 consecutive caesarean deliveries at Maputo Central Hospital. Of these 958 (46.3%) were performed by " tecnicos de cirurgia" while 53.7% were done by specialist Obstetricians and Gynaecologists. This comparative study showed that there was no

significant difference in the outcomes of surgery done by the two groups of surgeons. The study concluded that training medical assistants to perform caesarean sections even on women with poor general condition is justified in settings in which doctors are scarce [11]. In a subsequent study, 10,258 surgical operations carried out by 14 tecnicos de cirurgia were scrutinized. Of these interventions, 70% were emergency procedures while 30% were elective. The emergency interventions included caesarean sections, repair of uterine ruptures, obstetric hysterectomies, strangulated herniae with bowel resection, splenectomies, colostomies and open fractures. In this study, post-operative mortality was less than 1% [12].

In Tanzania, assistant medical officers constitute a vital component of the health care system and have contributed to the reduction of maternal mortality in some regions. In one audit in the region of Kigoma, maternal mortality was reduced by 80% by increasing staffing levels and delegating emergency surgery, particularly caesarean sections to assistant medical officers [10].

Fenton et al (1997) published an article “The epidemiology of district surgery in Malawi” and subsequently, “Caesarean section in Malawi: a prospective study of early maternal and perinatal mortality” [9, 18]. In the later paper he indicated that 65% of caesarean sections at central and district hospitals were performed by clinical officers. There is no indication as to how many caesarean sections were done by clinical officers at the district hospital alone. This percentage could probably be higher than 65%.

According to standards set by the RCM/RCOG working party in the United Kingdom, maternity units with a delivery rate of more than 1000 per year should have a minimum of 40 hours per week of consultant supervision for labour ward. Units with less than 1000 deliveries per year should have at least 2 consultant ward rounds per day to assess problems and those with more than 6000 deliveries should aim to have 24 hour consultant cover on the labour ward.

In an audit of 213 consultant led maternity units, there were an average of 2 consultants per 1000 deliveries. In 25% of these units, consultants were present on 55% of weekdays but few consultant ward rounds were reported. In 50% of units, consultant ward rounds were reported to have been undertaken on only 15% of weekdays during the study period (i.e. once every 7 to 8 days). Sixteen percent of maternity units with more than 1000 deliveries per year reported having at least 40 hours dedicated consultant cover per week. Fifteen percent reported not having any dedicated consultant cover. The average consultant cover in these units was 16 hours per week.

The working group also recommended that a consultant should be contacted prior to an emergency caesarean section and that they should be present for at least 10% of potentially complicated caesarean sections. In this audit, consultants were involved in the decision for 67% of emergency caesarean sections and were present for 21% of potentially complicated cases. Such cases include placenta previa, placenta abruption, caesarean section at full cervical dilatation, obese women, premature delivery less than 32 weeks, multiple gestation as well as multiple previous caesarean section [32].

In Malawi, the number of specialist obstetricians is too few to provide such supervision and they are mostly based at the central hospitals. It has to be noted that the midlevel provider is not uncommonly the most senior person at a hospital and will therefore make independent decisions to perform caesarean section.

Chapter 3

Training of health workers for emergency obstetric care in Malawi

Clinical officer training is conducted at the Colleges of Health Sciences. There are three of these institutions in the country. These institutions are linked to the country's three central hospitals as teaching hospitals. The minimum admission requirement is a school certificate of education (equivalent of O level) with a pass in English and credit passes in Mathematics, Physical Science, Biology or General Science. Candidates also sit an entrance examination conducted by the institutions in collaboration with the National Examinations Board.

The training is a three year programme. In the first year candidates are introduced to the basic medical sciences and pathology as well as Health systems management and research. In the second year, they are introduced to the theoretical aspects of the different clinical specialties. In the third year they are exposed to "hands on" experience in the clinical specialties. During their three years of training specialists and registrars from the different clinical specialties as well as other clinical officers are involved in their teaching. There is a barrier examination at the end of each year. Upon successful completion of their training, they are awarded a diploma in clinical medicine [33]. They then undergo one year of internship either at the district, Christian Health Association of Malawi (CHAM) or central hospital, during which they do three months' rotations through the departments of obstetrics and gynaecology, paediatrics, internal medicine and surgery. Specialists, registrars and medical officers in the central hospitals are also involved in this training while other senior clinical officers take up this role in the district hospitals where there are no

medical officers. By the end of their Obstetrics and Gynaecology rotation they are able to perform caesarean sections on their own and are trained to do hysterectomies which unfortunately are common due to the high numbers of uterine ruptures. Their basic training does not include anaesthetics. However they may take up anaesthesia as a specialty where they are trained for 18 months at the country's school of anaesthesia. After this they qualify as anaesthetic clinical officers.

Upon satisfactory completion of their internship, the clinical officers become registered practitioners with the country's health professions body, the Medical Council of Malawi, on the register of clinical officers. They are then employed by the Ministry of Health and are deployed into the various hospitals.

The colleges of health sciences also provide training for a cadre of health care workers called medical assistants. After their school certificate of education (equivalent of O level), they are trained for two years. The focus of their training is in the diagnosis and management of common medical conditions such as malaria, respiratory tract infection and diarrhoea. Upon completion of their training, medical assistant are posted at the lowest level of care, the dispensary, or the next level which is the health centre. They have no surgical training.

The other cadre performing caesarean sections in Malawi are medical officers. These are medical doctors mostly trained at the country's only medical school. Their training is a 5 year programme after which they are awarded a Bachelor of Medicine and Bachelor of Surgery degree (MB BS) by the University of Malawi [34]. They then undergo 18 months of internship. Sixteen of the 18 months is spent at the two central

hospitals where they rotate through the clinical departments as follows:

Obstetrics and Gynaecology (5 months)

Surgery (5 months)

Paediatrics (3 months)

Internal medicine (3 months)

The other 2 months is spent at the district hospitals where they do district hospital management and also district hospital clinical experience.

There are four main criteria for admission to the medical school.

- At least six O level passes including English and Mathematics; and three A level passes with a grade of at least C in Chemistry, Biology and one other science subject like Physics or Mathematics or
- At least six Malawi School Certificate of Education credit passes including English and Mathematics; and credit passes in Chemistry, Biology and one other science subject like Physics or Mathematics obtained at the end of second year of the Bachelor of Science programme at Chancellor College of the University of Malawi or
- At least six O level passes including English and Mathematics; and a pass in the pre medical science programme of the College of Medicine or
- Any other equivalent qualification approved by the College

Chapter 4

Aim of the study

The aim of the study was to evaluate the work done by clinical officers in the provision of comprehensive emergency obstetric care in Malawi.

Specific Objectives

The following were the objectives of the study:

1. To prospectively quantify the amount of emergency obstetric surgery performed by clinical officers during a two month period at all government district and CHAM hospitals
2. To evaluate the indications for caesarean section by clinical officers compared to medical officers
3. To assess the severity of preoperative morbidity of patients operated on by clinical officers compared to those operated on by medical officers
4. To measure adverse intra-operative events for selected parameters that could influence post-operative outcome for clinical officers and medical officers
5. To evaluate post-operative outcomes for selected parameters of surgery performed by clinical officers and medical officers

Chapter 5

Methods

This was a prospective descriptive and comparative audit of emergency and elective caesarean sections and other emergency obstetric operations by clinical officers and medical officers in Malawi. The study was conducted in all government district hospitals that perform caesarean sections and in Christian Health Association of Malawi (CHAM) hospitals. CHAM is a non profit making Christian organization that provides health care at a low cost especially in rural areas of Malawi. These are level one hospitals staffed by medical officers and clinical officers.

Before proceeding with the study, ethics approval was sought from College of Medicine Research and Ethics Committee (COMREC) and the National Health Services Research Committee (NHSRC) of Malawi. Once ethics approval was given, permission was then sought from Ministry of Health headquarters and CHAM secretariat.

All government district hospitals (N=21) and CHAM hospitals (N=19) were approached to participate in the evaluation. There were 21 government district hospitals where caesarean sections were performed during the study. Four tertiary level government hospitals were excluded from the study because these were referral hospitals with specialist cover which would result in differences in practice and outcome of caesarean sections. Nine of the 21 government hospitals had no medical officers and were entirely run by clinical officers. Nineteen CHAM hospitals were performing caesarean sections. However, we got consent to do the study in 17 of the 19 hospitals. Two CHAM hospitals under the same management did not allow us to

perform the evaluation in their hospitals.

Both clinical officers and medical officers start to perform caesarean sections during their internship. In Malawi, a standard caesarean section involves a midline subumbilical incision and a transverse lower uterine segment incision. The uterus is closed in 2 layers with visceral peritoneum left open. Sheath and skin is closed with nylon or PDS suture. Most of the caesarean sections are done under spinal anaesthesia which is administered by an anaesthetic clinical officer.

Allocation of surgery to either clinical officer or medical doctor was on an on call basis. An on call roster is drawn up every month. Both clinical officers and medical officers appear on the same roster and the person on call for the day is responsible for performing all the emergency and elective obstetric surgery.

Whenever an intra-operative complication is encountered, the clinical officer will seek the assistance of the medical officer if and when he/she is available. Where the medical officer is not available or is not able to handle the complication then the patient is referred to the next level of care, usually the central hospital.

The study was conducted over a period of two months from October to December 2005. During this period all patients undergoing obstetric surgical procedures, emergency and elective, were followed up from the time the decision to do surgery was made until discharge from hospital. Whenever it was feasible, the women were asked to come back one week after discharge from hospital for a follow up visit where an assessment of their recovery was made.

A reputable qualified nurse/midwife working in the maternity unit was recruited part time as a research assistant at each of the hospitals under study. This midwife was identified by the nursing officer in-charge during our first visit to the hospitals. We conducted a short intensive induction course, training them on the data collection process while also identifying areas that lacked clarity in the data collection tools and also allowing them to ask whatever questions they had.

Data was collected from the following three sources:

- Patient records
- Direct observation assessment of postoperative patients
- Administrative records for clinical officers and medical officers in their respective hospitals for information on place of training and years of experience

A simple structured data collection sheet was used to collect information on indication for caesarean section, pre-operative morbidity and its severity, intra-operative events as well as post-operative outcome. [Appendix 1]

Intra-operative information included cadre of anaesthetist and surgeon, type of anaesthesia, number and cadre of staff scrubbed for the procedure, type of abdominal incision and any intra-operative problems encountered. We also collected information about the institution where the clinical officer or medical officer did their internship and the duration of practice post internship.

The following postoperative outcomes were assessed:

- postoperative pyrexia, defined as two or more temperature readings of 38 degrees Celsius and above more than 24

hours post-operatively

- postoperative mortality
- number of days spent in hospital postoperatively
- total wound dehiscence
- partial wound dehiscence
- wound infection
- need for re-operation
- postoperative bleeding
- neonatal condition
- Immediate and 24 hour maternal condition postoperatively.

The research assistant was expected to make a subjective assessment of the patient's general condition while also collecting objective data such as blood pressure, pulse rate, post operative haemoglobin level and blood loss per vaginum and/or from the incision site. Patients were assigned to the categories of fair, sick or very sick depending on the research assistant's subjective and objective assessment. Patients with abnormality in 0 to 2 of the following parameters were assessed as fair. Those with 3 to 4 abnormal parameters were assessed as being sick and abnormality in all 5 parameters was assessed as very sick. The following guidelines applied in the assessment of the five parameters.

- Pulse of 40 beats per minute and less or 110 beats per minute and more
- Diastolic blood pressure of 40 or less and systolic blood pressure of 90 or less

- Haemoglobin level less than 8g/dl
- Blood loss of 500ml or more per vagina or a completely soaked wound dressing
- Temperature of 38 degrees Celsius or more, or less than 36 degrees Celsius

To ensure collection of good quality data, a second round of supervisory visits was made to all the hospitals and further queries were clarified. This visit was done by the principal investigator with one of the co-investigators.

Allocation of surgery to either clinical officer or medical doctor was on an on call basis. An on call roster is drawn up every month. Both clinical officers and medical officers appear on the same roster and the person on call for the day is responsible for performing all the emergency and elective obstetric surgery.

Whenever an intra-operative complication is encountered, the clinical officer will seek the assistance of the medical officer if and when he/she is available. Where the medical officer is not available or is not able to handle the complication then the patient is referred to the next level of care, usually the central hospital.

To ensure anonymity of individuals performing surgery, all hospitals were identified by a code only known to the research personnel. This code was also used for data entry.

Data was entered into the Statistical Package for the social Sciences version 11.0 (SPSS) and the Chi square test was used to test significance of the differences in outcome of surgery done by clinical officers and medical officers. In order to determine statistically the factors that contributed to maternal death, we did regression analysis. We ran a model using maternal death as a dependent variable and the following as independent variables: postoperative condition after 24 hours, blood transfusion, post operative fever and wound dehiscence.

In another model we used 24 hour condition as a dependent variable and regressed this with intraoperative complication, blood transfusion, type of anaesthesia and need for re-operation.

Chapter 6

Results

A total of 2131 obstetric operations were performed in the 38 centres during the study period. 1430 (67.1%) were performed in government district hospitals and 701 (32.9%) in CHAM hospitals. Clinical officers performed 1875 (88%) of these operations while medical officers performed 256 (12%) of the operations.

No distinction was made between elective and emergency procedures during data collection. However, calculating from the main indications of these procedures, more than 80% were done on an emergency basis. Only a few cases of previous caesarean sections and breech presentation were performed electively.

In government district hospitals, clinical officers performed as many as 92.9% of the caesarean sections and 77.8% in CHAM hospitals.

The median age of women undergoing caesarean section was 23 years with a range of 10 to 47 years. Median parity was 1 and the majority of them had education below grade 8 of primary school (Table 1)

Table 1

Patients' demographic data

	Median	**Range**
Age (years)	23.0	10 – 47
Gravidity	2	1 – 12
Parity	1	0 – 11
Gestational age (weeks)	38	22 - 44
Marital status	Frequency	Percentage
Married	2038	95.6
Single	53	2.5
Divorced/separated	15	0.7
Widowed	3	0.1
No information	22	1.0
Total	2131	100

The majority of the patients (98.8%) had unknown HIV status while 26 (1.2%) were known to be positive. One hundred and fifty-six (7.3%) had anaemia (haemoglobin level less than 8g/dL) at the time of presentation for caesarean section. Pre-operative antibiotics were administered in 1387 (65.1%) cases while 743 (34.9%) did not receive pre-operative antibiotics. There was no information regarding antibiotic therapy on one of the cases.

The type of surgical operation performed ranged from standard caesarean sections to those combined with subtotal hysterectomy, total hysterectomy, repair of uterine rupture and bilateral tubal ligation. The majority of the surgical operations performed were standard caesarean sections or caesarean section and bilateral tubal ligation. Clinical officers performed 77 complicated procedures (11 caesarean section plus subtotal hysterectomies, 7 caesarean sections plus total hysterectomies and 59 repairs of uterine rupture). This is more in absolute numbers than the 18 complicated procedures performed by medical officers. However, of the total surgery performed by medical officers, a higher proportion (7%) was complicated compared to 4.1% of operations performed by clinical officers. The indications for these hysterectomies were severe rupture of the uterus not amenable to repair, severe haemorrhage from uterine rupture or atony as well as postoperative intra-abdominal sepsis. (Table 2)

Table 2

Proportions of complicated surgery

Type of operation	**Clinical officer**	**Medical officer**	**Total**	**P value**
C/S only	1569 (83.7%)	185 (72.3%)	1754 (82.3%)	< 0.0001
C/S + subtotal hysterectomy	11 (0.6%)	8 (3.1%)	19 (0.9%)	< 0.0001
C/S + total hysterectomy	7 (0.4%)	3 (1.2%)	10 (0.5%)	N/A
C/S + repair of uterine rupture	59 (3.1%)	7 (2.7%)	66 (3.1%)	0.3605
C/S + bilateral tubal ligation	224 (11.9%)	53 (20.7%)	277 (13.0%)	< 0.0001
Not indicated	5 (0.3%)	0 (0.0%)	5 (0.2%)	N/A
Total	**1875 (100%)**	**256 (100%)**	**2131 (100%)**	**-**

The diagnoses at the time of admission were comparable between the two groups of surgeons. The top ten diagnoses at admission were labour pain, cephalopelvic disproportion, obstructed labour, elective caesarean section, antepartum haemorrhage, breech presentation, anaemia, multiple gestation, pre-eclampsia and suspected ruptured uterus.

Obstructed labour, cephalopelvic disproportion and previous uterine operation were the most frequent indications for caesarean section for both cadre of surgeon. Clinical officers performed a higher proportion of their caesarean sections for obstructed labour than medical officers. On the other hand, medical officers performed a higher proportion of their caesarean sections for fetal distress, eclampsia and cord prolapse than clinical officers. There was no statistically significant difference in proportions for the rest of the other major indications. (Table 3)

Table 3

Main indications for caesarean section according to the surgeon's cadre

Main Indication	**Clinical officer (%)**	**Medical officer (%)**	**Total (%)**	**P value**
Obstructed labour	609 (32.5)	57 (22.3)	666 (31.3)	0.005
Cephalopelvic disproportion	408 (21.8)	56 (21.9)	464 (21.8)	0.4832
Previous uterine operation	399 (21.3)	55 (21.5)	454 (21.3)	0.4701
Fetal distress	139 (7.4)	36 (14.1)	175 (8.2)	0.0001
antepartum haemorrhage	92 (4.9)	11 (4.3)	103 (4.8)	0.3347
Breech presentation	66 (3.5)	6 (2.3)	72 (3.4)	0.1643
Suspected ruptured uterus	53 (2.8)	9 (3.5)	62 (2.9)	0.2693
Eclampsia	48 (2.6)	13 (5.1)	61 (2.9)	0.0117
Cord prolapse	31 (1.7)	10 (3.9)	41 (1.9)	0.0069
Other	30 (1.6)	3 (1.2)	33 (1.6)	-
Total	**1875 (100)**	**256 (100)**	**2131 (100)**	**-**

Spinal anaesthesia was the dominant form of anaesthesia for caesarean section for

both cadres of surgeons. However, medical officers did significantly higher proportions of caesarean sections under general anaesthesia. (Table 4)

Table 4

Type of anaesthesia and cadre of individual performing surgery

(Proportion is entity/total operations within column)

Type of Anaesthesia	**Clinical officer**	**Medical officer**	**Total**	**P value**
Spinal	1362 (72.6%)	138 (53.9%)	1500 (70.3%)	< 0.0001
General	393 (21.0%)	88 (34.4%)	481 (22.6%)	< 0.0001
Ketamine	88 (4.7%)	27 (10.5%)	115 (5.4%)	<0.0001
Infiltration	1 (0.1%)	0 (0.0%)	1 (0.05%)	N/A
No information	31 (1.7%)	3 (1.2%)	34 (1.6%)	
Total	**1875 (100%)**	**256 (100%)**	**2131 (100%)**	-

Anaesthesia was largely administered by anaesthetic clinical officers who are clinical officers specially trained in anaesthetics for 18 months full time. There was no instance where the surgeon had to give the anaesthetic. (Table 5)

Table 5

Cadre of Anaesthetist and cadre of surgeon

Cadre of anaesthetist	**Clinical officer**	**Medical officer**	**Total**
Clinical officer	1480 (78.9%)	195 (76.2%)	1675 (78.6%)
Nurse	211 (11.3%)	34 (13.3%)	245 (11.5%)
Medical assistant	146 (7.8%)	18 (7.0%)	164 (7.7%)
Medical officer	13 (0.7%)	6 (2.3%)	19 (0.9%)
No information	25 (1.3%)	3 (1.2%)	28 (1.3%)
Total	**1875 (100%)**	**256 (100%)**	**2131 (100%)**

The operating team invariably comprised of two people. This was usually the surgeon and a scrub nurse/midwife who is also the surgeon‘s assistant. It is not uncommon to have unqualified personnel such as auxiliary nurse- aids assisting in emergency caesarean sections due to lack of qualified personnel.(Table 6)

Table 6

Cadre of surgical assistant scrubbed for operation

Surgical assistant	**Clinical officer**	**Medical officer**	**Total**
Nurse/midwife	1635 (87.2)	198 (77.3)	1833 (86.0)
Auxiliary nurse	16 (0.9)	1 (0.4)	17 (0.8)
Medical officer	8 (0.4)	7 (2.7)	15 (0.7)
Clinical officer	90 (4.8)	33 (12.9)	123 (5.8)
Auxiliary nurse-aid	87 (4.6)	13 (5.1)	100 (4.7)
Intern clinical officer	10 (0.5)	0	10 (0.5)
No information	29 (1.5)	4 (1.6)	33 (1.5)
Total	**1875 (100%)**	**256 (100%)**	**2131 (100%)**

Internship for clinical officers is done in central hospitals with specialists available, government district hospitals where mostly other senior clinical officers will teach them how to perform caesarean sections or in CHAM hospitals. Clinical officers who did their internship at the district hospital performed most of the caesarean sections. Medical officers only did their internship in the central hospitals. (Table 7)

Table 7

Type of hospital where surgeon did internship and amount of surgery performed

Type of hospital	**Cadre of surgeon**		**Total**
	Clinical officer	Medical officer	
District hospital	948 (50.6)	-	948 (44.4)
CHAM	476 (25.4)	-	476 (22.3)
Central hospital	447 (23.8)	199 (77.7)	646 (30.3)
Expatriate	-	55 (21.5)	55 (2.6)
No information	4 (0.4)	2 (0.8)	6 (0.3)
Total	**1875 (100%)**	**256 (100%)**	**2131 (100%)**

Clinical officers with more than 4 years of practice post internship performed the most caesarean sections. Some of the caesarean sections were performed by clinical officers who were undergoing their internship (Table 8)

Table 8

Duration of practice of the individual performing surgery and the number of operations done

Duration	**Clinical officer**	**Medical officer**	**Total**
Less than one year	401 (21.4)	44 (17.2)	445 (20.9)
2 to 3 years	456 (24.3)	51 (19.9)	507 (23.8)
More than four years	832 (44.4)	151 (59.0)	983 (46.1)
None/ Internship year	175 (9.3)		175 (8.2)
No information	11 (0.6)	10 (3.9)	21 (1.0)
Total	**1875 (100%)**	**256 (100%)**	**2131 (100%)**

The data collection sheet was designed to identify cases of intra-operative surgical complications such as ureteric, bladder and intestinal injury. During the entire study period, no such cases were reported.

No statistically significant difference was found in neonatal outcomes, immediate as well as 24 hour maternal general condition post operatively and other maternal post operative outcomes for surgery performed by clinical officers and medical

officers.(Table 9 – 12)

Table 9

Postoperative neonatal outcomes

Neonatal outcome	**Clinical officer**	**Medical officer**	**Total**
Alive and well	1604(85.5%)	213(83.2%)	1817(85.2%)
Alive and unwell	70(3.7%)	9(3.5%)	79(3.7%)
Stillborn	160(8.5%)	29(11.3%)	189(8.9%)
Early neonatal death	41(2.2%)	4(1.6%)	45(2.1%)
No information	-	1(0.4%)	1(0.0%)
Total	**1875 (100%)**	**256 (100%)**	**2131 (100%)**

Difference not statistically significant, p = 0.709

Table 10

Immediate post operative maternal condition

Condition	**Clinical officer**	**Medical officer**	**Total**
Fair	1700(90.7)	235(91.8)	1935(90.8)
Sick	105(5.6)	17(6.6)	122(5.7)
Very sick	27(1.4)	3(1.2)	30(1.4)
No information	43(2.3)	1(0.4)	44(2.1)
Total	**1875 (100%)**	**256 (100%)**	**2131 (100%)**

Difference not statistically significant, p = 0.786

(see definition of categories in methods)

Table 11

Maternal general condition 24hours post operation

Condition	**Clinical officer**	**Medical officer**	**Total**
Fair	1765 (94.1)	243 (94.9)	2008 (94.2)
Sick	59 (3.1)	9 (3.5)	68 (3.2)
Very sick	20 (1.1)	1 (0.4)	21 (1.0)
No information	31 (1.7)	3 (1.2)	34 (1.6)
Total	**1875 (100%)**	**256 (100%)**	**2131 (100%)**

Difference not statistically significant, p = 0.564

Table 12

Other maternal post-operative outcomes

Condition	**Clinical officer**	**Medical officer**	**P value**
Fever	388 (20.7)	56 (21.9)	0.562
Wound infection	137 (7.3)	14 (5.5)	0.361
Wound dehiscence	40 (2.1)	4 (1.6)	0.813
Need for re-operation	28 (1.5)	5 (2.0)	0.582
Maternal death	22 (1.2)	1 (0.4)	0.512

Twenty-three cases of maternal death were reported during the study period. This is 1.07% of the total numbers of caesarean sections in this sample (n = 2131). Twenty-two of these occurred after surgery by clinical officers (1.2%) and one by medical officer (0.4%). Preoperatively, 3 of these patients were anaemic, 2 were hypertensive, 2 had malaria and 3 had AIDS. Thirteen patients had spinal anaesthesia, 5 had general anaesthesia and were operated on under ketalar. The indications for surgery were previous uterine operation, obstructed labour, eclampsia, suspected rupture of uterus, fetal distress and cephalopelvic disproportion. (Table 13)

Table 13

Maternal death by indication for caesarean section

Diagnosis	**Number dead N = 23**	**Number with diagnosis**	**Case fatality**
Eclampsia	3	61	4.9%
Obstructed labour	9	666	1.4%
Previous C/section	2	454	0.4%
Suspected ruptured uterus	5	62	8.1%
Fetal distress	1	175	0.6%
Cephalopelvic disproportion	3	464	0.6%

Table 14 shows the proportions of maternal deaths by actual operative procedure performed.

Table 14

Maternal death by operative procedure

Procedure	Number dead N = 23	Number undergoing procedure	% of patients undergoing procedure
C/section only	11	1569	0.7
C/s + subtotal hysterectomy	2	11	18.2
C/s + total hysterectomy	2	7	28.6
C/s + repair of uterine rupture	6	59	10.2
C/s + tubal ligation	1	224	0.4
No information	1	-	

The final cause of death was identifiable in 48% (11) of the cases. Eight patients died from sepsis (5 genital tract, 2 frank peritonitis and 1 respiratory infection) while postpartum haemorrhage, ruptured uterus and eclampsia accounted for one death each. One patient with a ruptured uterus and massive post-partum haemorrhage was referred to the central hospital after a hysterectomy was performed at the district

hospital due to intractable bleeding. The final cause of death was not established in the other 52% of cases. Post-mortem was not performed in any of the cases of maternal death. This service is not readily available to most of the district hospitals since there are only 3 pathologists in the country and all of them are based at the university teaching hospital. There is also a great reluctance of relatives to consent for post-mortem even within the university teaching hospital.

In the regression analysis to determine statistically the factors that contributed to maternal death, only 24 hour postoperative condition, blood transfusion and wound dehiscence significantly correlated with maternal death. The relationship was positive thus suggesting that a mother who undergoes caesarean section is more likely to die if she is critically ill within the first 24 hours post operatively, if she is transfused and if she has wound dehiscence.

In the second model, intra-operative complication, blood transfusion, type of anaesthesia and need for re-operation had a positive relationship with 24 hour condition.

Chapter 7

Discussion

The study established that the majority of emergency obstetric surgery during the study period was performed by clinical officers. They performed 88% of such surgery while medical officers performed 12%. They performed such complicated procedures as repair of uterine rupture and hysterectomy with similar post operative outcome.

This study had some limitations. Firstly, the allocation of surgery to the two cadres of surgeons was simply by following an on call roster and therefore not randomized. This rendered the study open to selection bias with the result that a particular cadre was operating on a particular group of patients. The fact that there was cross referral of cases from clinical officers to medical officers also creates a bias since the medical officers may then have operated on more complicated cases.

Secondly, a standard severity score for preoperative morbidity would have been an objective indicator of similarity of cases operated on by the two cadres of surgeons as opposed to the use of surgical indications. Lack of such a tool renders assessment of severity more subjective than objective.

Thirdly, it may also be argued that the placing of a local health worker with well known competence as an “impartial”(though non-blinded as far as type of surgeon was concerned) individual might imply another bias. Although assessment of postoperative outcome is largely a subjective matter, we attempted to make it as objective as possible by asking them to collect such objective data as blood pressure

level, pulse rate, amount of vaginal bleeding, postoperative pyrexia, wound infection, wound dehiscence and the need for re-operation in addition to the general outlook of the patient. The involvement of a different cadre of health care workers other than clinical officers or medical officers was also thought to reduce bias.

The lack of distinction between elective and emergency surgery during data collection may also have presented another bias. Since emergency caesarean sections are known to be associated with significantly more morbidity, such distinction would have been useful. Such bias, however may have been offset by the much higher proportion of emergency procedures (more than 80%) compared to elective ones (less than 20%).

The majority of the patients (98.8%) undergoing caesarean section in these hospitals during the study period were not tested for HIV. This low rate of HIV testing was due to the fact that the Prevention of Mother to Child Transmission of HIV (PMTCT) programme which had been rolled out a year before in the country had not taken effect in these rural areas at the time of the study.

It is important to note that 4.1% (77/1875) of the surgical procedures performed by clinical officers compared to 7.0% (18/256) by medical officers were complicated, requiring subtotal or total abdominal hysterectomy or repair of uterine rupture. The morbidities from such surgical procedures included fever, wound sepsis, haemorrhage and wound dehiscence among others. No cases of pelvic organ injury were reported during the study period. Since the data collection tool did not specifically ask about pelvic organ injuries, some of such injuries may have been missed in the reporting.

Fenton et al (1997), in an earlier study found that 65% of caesarean sections at central and district hospitals were done by clinical officers. Clinical officers referred some of the complicated cases to medical officers. Unfortunately the data collection tool did not capture this aspect of care. This was because such referrals are not very common due to the vast experience that the senior clinical officers have in handling such common complications of obstructed labour as ruptured uteri. In one hospital, all potentially complicated procedures were directly referred to the central hospital since at the time of the study there was no expertise to handle them. Such cases were not captured in our data since they did not have their surgery done in the district hospitals.

One case with ruptured uterus and massive postpartum haemorrhage was referred to the central hospital after a hysterectomy was done because the patient continued to bleed after going into disseminated intravascular coagulation and died on arrival at the central hospital. This was the only reported case of cross referral from clinical officer to medical officer.

The diagnoses at the time of admission were comparable between the two cadres of surgeons as were the primary indications for surgery e.g. obstructed labour, cephalopelvic disproportion and previous caesarean section. The finding that medical officers performed significantly more caesarean sections for fetal distress, eclampsia and cord prolapse may have been due to chance.

Although spinal anaesthesia was the predominant form of anaesthesia for the two groups of surgeons, medical officers had proportionately more surgical operations done under general anaesthesia. This was due to the fact that this cadre of surgeons

also had a proportionately larger number of complicated procedures.

As many as 948 (50.6%) surgical operations were performed by clinical officers who did their internship at the district hospital. The significance of this is that these clinical officers are trained by other clinical officers to perform caesarean sections since in the district hospitals there are no obstetricians or obstetric registrars to train them. In some instances even clinical officers undergoing internship were doing caesarean sections on their own. The rationale behind collecting this information was that clinical officers who did their internship at central hospitals, under specialist supervision, were expected to be more competent than those trained at the district hospital.

Most surgical operations were performed by clinical officers and medical officers who had more than four years of practice after their internship. Their vast experience could explain the low rate of complications of their surgery. With the medical officer presumed to be the provider of optimal surgical care, the outcome of surgery done by clinical officers was compared with those done by the medical officers. No statistically significant difference in outcome was observed.

Febrile morbidity and wound infection were the commonest complications of caesarean sections by both cadres of surgeons. Febrile morbidity occurred in 20.7% of surgery by clinical officers and 21.9% of surgery by medical officers. On the other hand, wound sepsis occurred in 7.3% vs 5.5%, respectively. The study did not attempt to sub-classify the causes of febrile morbidity. However, with the background of 30% of all antenatal mothers being HIV infected, non pregnancy related causes are presumed to be high [35].

In a study by Beattie et al the rates of infection were noted to vary very widely because of the many variables that are thought to alter the risk of developing this complication. Febrile morbidity ranged from 0 – 66 % while wound infection ranged from 0 – 24% [36]. It is encouraging to note that our results for both cadres were well within these ranges. However, the lack of guidelines for the use of preoperative antibiotics in these hospitals is a cause for concern. Seven hundred and forty-three patients (34.9%) did not receive preoperative antibiotics. It was noted hat some patients were put on long courses of postoperative antibiotics, when such was not indicated. The provision of such guidelines comes out as one of the recommendations from this study.

Patients who presented with suspected ruptured uterus, eclampsia and obstructed labour suffered the highest mortality. The morbidity specific case fatality rates (CFR) of these conditions were above the WHO acceptable target of less than 1% [37]. However it should be noted that the WHO target refers to the "crude" CFR, implying all deaths divided by all morbidities which we consider gives too blunt a picture of the quality of emergency care. Our morbidity specific CFR is a more appropriate measure of the quality of care per condition assessed.

The major cause of maternal death (where clearly identifiable) was sepsis. This is similar to the findings of the confidential enquiry into institutional maternal deaths in the southern region of Malawi by Ratsma. Other factors than events surrounding the surgery come into play. Most of these patients will have spent a number of days on the way to hospital due to social, cultural, economic as well as geographic barriers. Patients do come from as far across the border as Mozambique almost always in

critical condition.

The trend to higher maternal mortality rate after surgery by clinical officers compared to medical officers is a cause for concern. However the difference was not statistically significant since the numbers were small. Most of the mortality in this study can be ascribed to the underlying obstetric condition rather than the surgeon /surgery. It is an additional limitation of the study that the cause of maternal death was unknown in 12 of the 23 maternal deaths.

The problem of high maternal mortality ratios and perinatal mortality rates is endemic to poor income countries. Multiple factors are involved in precipitating the death of women and children at and around the time of childbirth. Such factors include:

(a) the non-availability of a sound health care system
with adequate essential supplies

(b) inadequate facilities for emergency obstetric care,
both basic and comprehensive

(c) social, cultural and political factors

(d) absence of skilled attendants at the time of delivery
[10, 38].

In the face of the current human resource crisis each country poor or rich needs to have a national workforce plan shaped to its own situation and crafted to address its health needs. Due to the chronic shortage of medical doctors, Malawi has for many years now depended on clinical officers for the provision of health services both in the rural and urban areas of the country. This may be considered a variant of the “two

tier" system of training where some health personnel are trained to a basic level and are therefore more likely to be retained in the country [39, 40].

Chapter 8

Conclusion

Clinical officers are providing an extensive service in major emergency obstetric surgery in Malawi. They are filling an important human resource deficit in the absence of medical doctors. The results show that they deal with both normal and complicated caesarean sections without significant increase in morbidity and mortality compared to medical officers. With appropriate support structures such as an efficient health care system, these midlevel health care providers can replicate the picture of trained midwives (who mastered forceps deliveries, understood the importance of hand hygiene and were able to efficiently stop post partum uterine bleeding) in Sweden between 1751 and 1908 where there was a reduction in maternal mortality ratio from over 1000 to less than 250 per 100,000 live births [41]. It has to be noted however that although today's clinical officers in Malawi are equipped to handle the bulk of the problems facing women at delivery, there is an unequivocal need for the support of medical doctors and specialists who are well trained to manage cases at the top of the pyramid, above all as instructors, giving professional and scientific support and encouragement to all cadres of health workers with the intention to maintain optimal quality of emergency obstetric care to all women in need.

Future research is aimed at assessing the decision making ability of the clinical officers in their day to day management of obstetric patient as well as the long term impact of this innovative human resource strategy in the reduction of maternal mortality towards the year 2015 and beyond.

REFERENCES

1. Palmer D. Tackling Malawi´s human resource crisis. Reproductive Health Matters 2006; 14(27): 27 – 39.
2. United Nations Development Programme. The impact of HIV/AIDS on human resources in the Malawi public sector, UNDP, Lilongwe 2002.
3. Malawi Country Health System Fact Sheet. WHO at http://www.afro.who.int/home/countries/fact_sheet/malawi.pdf
4. Ministry of Health and Population. Five-Year Human Resources Development Plan 1999 – 2004 (Vol III), Lilongwe, Government of Malawi (1998)
5. Chen L, Evans T et al. Human resources for health: overcoming the crisis. Lancet 2004; 364: 1984 – 1990.
6. Hagopian A, Thompson M.J, Fordyce M, Johnson K.E, Hart L.G. The migration of physicians from sub-Saharan Africa to United States of America: measures of the African brain drain. Human Resources for Health 2004; 2: 17
7. Fernando D, Jaya Tilleka A, Karunaratna V. Pregnancy -reducing maternal deaths and disability in Sri Lanka: national strategies. Br Med Bull 2003; 67:85 – 98.
8. Liljestrand J, Pathmanathan I. Reducing maternal mortality: can we derive policy guidance from developing country experiences. J Public Health Policy 2004; 25: 299 – 314.
9. Fenton P M. The epidemiology of district surgery in

Malawi. East Centr Afr J Surg 1997; 3: 33 – 41.

10. Mbaruku G, Bergström S. Reducing maternal mortality in Kigoma, Tanzania. Health Policy Plan 1995; 10: 71 – 78.
11. Pereira C, Bugalho A, Bergström S, Vaz F, Cotiro M. A comparative study of caesarean deliveries by assistant medical officers and obstetricians in Mozambique. Br J Obstet Gynaecol 1996; 103: 508 – 512.
12. Vaz F, Bergstrom S, Vas M, Langa J, Bugalho A. Training medical assistants for surgery. Bull WHO 1999; 77: 688 - 691
13. De Brouwere V, Tonglet R, Van Lerberghe W. Strategies for reducing maternal mortality in developing countries: what can we learn from the history of the industrialized west. Trop Med Int Health 1998; 3: 771 - 782
14. Bale JR, Stoll BJ, Lucas AO. Improving Birth Outcomes: Meeting the challenge in the developing world. Committee on Improving Birth Outcomes. Board on Global Health (BGH); 2003: 60.
15. Hogberg U. The decline in maternal mortality in Sweden: The role of community midwifery. American Journal of Public Health 2004; 94 (8): 1312 - 1320
16. Okonofua F, Dumont A. Optimising caesarean section rates in West Africa. Lancet 2001; 358: 1329 - 1333
17. Ratsma Y E C. Why more mothers die. The confidential enquiries into institutional maternal deaths in the Southern Region of Malawi 2001. Malawi Safe Motherhood Project

18. Fenton P M, Whitty C J M, Reynolds F. Caesarean section in Malawi: Prospective study of early maternal and perinatal mortality. BMJ 2003; 327: 587 – 91.

19. Saving Mothers. Third report on confidential enquiries into maternal deaths in South Africa 2002 - 2004. Department of Health, South Africa. 2006

20. Grubert A T. Complications after caesarean section in HIV 1 infected women not taking antiretroviral treatment. Lancet 1999; 354: 1612 -1613

21. Hawkins JL, Koonin LM, Palmer SK, Gibbs CB. Anaesthesia -related deaths during obstetric delivery in the United States 1979 - 1990. Anaesthesiology 1997; 86: 277-284

22. Confidential Enquiry into Maternal and Child Health (CEMACH). Saving mothers' lives. 2003 - 2005; www.cemach.org.uk. December 2007.

23. Greer I A. The special case of venous thromboembolism in pregnancy. Haemostasis 1998; 28: 22 - 34

24. Lowe G, Greer I, Cooke T et al. Risk and prophylaxis for thromboembolism in hospital patients. BMJ 1992; 305: 567 – 574

25. Kieser K E, Baskett T F. A 10 year population based study of uterine rupture. Annual clinical meeting, American College of Obstetricians and Gynaecologists 2002; 100 (4): 749 - 753

26. Elvedi-Gasparovic V, Klepac-Palunic T, Peter B. Maternal and fetal outcome in elective versus emergency caesarean section in a developing country. Coll. Anthropol 2006; 30 (1): 113 - 118

27. National Institute for Health and clinical excellence. Clinical guideline 13. Caesarean section. www.nice.org.uk . April 2004.

28. Gordon C S, Pell J P, Bobbie R. Caesarean section and the risk of unexplained stillbirth in subsequent pregnancy. Lancet 2003; 362: 1779 - 1784

29. Wood SL, Chen S, Ross S, Sauve R. The risk of unexplained ante partum stillbirth in second pregnancies following caesarean section in the first pregnancy. BJOG 2008; 115 (6): 726 - 731

30. Smith J F, Hernandez C, Wax J. Fetal laceration injury at caesarean delivery. Obstet Gynaecol 1997; 90: 344 - 346

31. Thomas J, Paranjothy S. Royal College of Obstetricians and Gynaecologists Clinical Effectiveness Support Unit. National sentinel caesarean section audit report. RCOG press; 2001

32. RCM/RCOG working party. Safer childbirth. Minimum standards for the organisation and delivery of care in labour. http://www.rcog.org.uk/resources/public/pdf/safer_childbirth_report_web.pdf.

33. Faculty of health sciences, curriculum development workshop. Curriculum for diploma in clinical medicine. Malawi College of Health Sciences 2002

34. University of Malawi - College of Medicine. Curriculum for the Bachelor of Medicine, Bachelor of Surgery programme. http//www.medcol.mw/mbbs.hph. March 2006 October 2007.

35. Taha TE, Dallabetta GA et al. Trends of HIV-1 and sexually transmitted diseases among pregnant and post partum women in urban

Malawi. AIDS 1998; 12(2): 197 - 203

36. Beattie PG, Rings TR, Hunter MF, Lake Y. Risk factors for wound infection following caesarean section. Aust NZ J Obstet Gynaecol 1994;34: 398 - 402

37. Meyers J, Lobis S, Dakkak H. UN process indicators: key to measuring maternal mortality reduction. http://www.fmreview.org/FMRpdfs/FMR19. February 2004.

38. AbouZahr C, Royston C. Maternal mortality: A global factbook. World Health Organization, Geneva; 1991.

39. Gent S, Skeldon R. Skilled migration: Health care policy options. Briefing 2006; 6: 1 - 4

40. Dovlo D. Using midlevel cadres as substitutes for internationally mobile health professionals in Africa. A desk review. Hum Resour

41. Maternal mortality in Sweden. http://www.who.int/reproductive health/publications/reduction_of_maternal_mortality_chap2.htm. 1999.

Appendix 1

CAESAREAN SECTIONS AND OTHER OBSTETRIC ABDOMINAL SURGICAL INTERVENTIONS BY CLINICAL OFFICERS IN MALAWI

16th April 2005

{COLLEGE OF MEDICINE}
[UNIVERSITY OF MALAWI]

IDENTIFICATION		
HOSPITAL CODE NUMBER		☐☐☐☐☐☐☐☐
TYPE OF HOSPITAL	GOVERNMENT CHRISTIAN HOSPITALS ASSOCIATION OF MALAWI	☐ ☐
PATIENT'S CODE NUMBER		☐☐☐☐☐☐☐☐

DATA COLLECTOR'S SPECIFICATIONS	
Professional Qualification	
Years of Experience	☐☐
Current Position	

SECTION 1. PATIENT'S BACKGROUND

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
101	Age	☐☐	
102	Diagnosis at arrival in hospital	Anaemia ..... 1 Labour pain ..... 2 Breach ..... 3 Multiple Gestation ..... 4 Pre-Eclampsia ..... 5 Eclampsia ..... 6 Antepartum Haemorrage ..... 7 Placenta Preavia ..... 8 Obstructed Labor ..... 9 Suspected Raptured Uterus ..... 10 OTHER _____ (SPECIFY) 98	
103	Diagnosis motivating operation (indications)	Previous Uterus Operation ..... 1 Obstructed Labor ..... 2 Antepartum Haemorrage ..... 3 Eclampsia ..... 4 Placenta Preavia ..... 5 Breach ..... 6 Cold products ..... 7 Suspected Raptured Uterus ..... 8 OTHER _____ (SPECIFY) 98	
104	Previous Diseases	Tuberculosis ..... 1 Vaginal Warts ..... 2 High Blood Pressure ..... 3 Heart Disease ..... 4 Asthma ..... 5 Sexually Transmited Diseases ..... 6 OTHER _____ (SPECIFY) 98	
105	Number of days in hospital before surgery	☐☐	
106	Medical treatment prior to surgery	Antibiotics ..... 1 Antimararial ..... 2 Blood transfusion ..... 3 Intravenous Fluids ..... 4 OTHER _____ (SPECIFY) 98	
107	Pre-operative illness (its severity and character)	Mild 1 / Moderate 2 / Severe 3 Anemia ☐ ☐ ☐ High Blood Pressure ☐ ☐ ☐ Pre-Eclampsia ☐ ☐ ☐ Eclampsia ☐ ☐ ☐ Malaria ☐ ☐ ☐ HIV/AIDS ☐ ☐ ☐ OTHER _____ ☐ ☐ ☐ Specify	

SECTION 2. SURGICAL INTERVENTION

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
201	Individual performing surgery	Clinical Officer ..... 1 Medical Officer ..... 2 Specialist 3	
202	Competence of individual performing surgery (Training)	District Hospital ..... 1 CHAM Hospital ..... 2 Central Hospital 3	
203	Competence of individual performing surgery (Practical Experience)	Experience less than 1 yr ..... 1 Experience 2-3 yrs ..... 2 Experience 4 yrs plus 3	
204	Type of surgical intervention	CS only ..... 1 CS + sub-tot hyst. ..... 2 CS + total hyst. ..... 3 CS + repair of uterine rupture ..... 4 CS + tub lig. ..... 5 No information 6	
205	Duration of surgical intervention (in minutes)	☐☐	
206	Status of Anaesthetist	Clinical Officer ..... 1 Specialist ..... 2 OTHER _____ (SPECIFY) 98	
207	Type of Anesthesia	Spinal ..... 1 Genral ..... 2 Kaetaler ..... 3 Infiltration ..... 4 OTHER _____ (SPECIFY) 98	
208	Intraoperative complication	Aneasthetiological ..... 1 Surgical ..... 2 None 3	
209	Blood units given	Zero ..... 1 One ..... 2 Two ..... 3 Three or more 4	
210	Category of surgical assistant	Nurse/Midwife ..... 1 Auxiliary Nurse ..... 2 Clinical Officer ..... 3 Medical Officer 4	

SECTION 3. POST-OPERATIVE OUTCOME

301	Immediate post-operative condition	Fair ..... 1 Sick ..... 2 Very sick 3	
302	*24 hours post-operative condition*	Fair ..... 1 Sick ..... 2 Very sick 3	
303	Post-operative complications *(Tick more than one)*	Fever Wound infection Wound rupture Need of re-operation Medic treat post-operatively	
304	Hospital stay post-op.	> 5 days	Yes ..... 1 No 2
305	Medication after discharge	Yes ..... 1 No 2	
306	Post-natal check-up	Yes ..... 1 No 2	

OBSERVATIONS

COMMENTS ABOUT CLARITY OF INFORMATION:

Were case notes available and legible?

COMMENTS ON SPECIFIC QUESTIONS:

ANY OTHER COMMENTS:

PRINCIPAL INVESTIGATOR'S OBSERVATIONS

NAME OF INVESTIGATOR: _____ DATE: _____