The Brikama Obstetric Project: a description and interim analysis

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MCAI Maternal & Childhealth Advocacy International

Advanced Life Support Group
A charity dedicated to saving life by providing training

Dr Alice Clack, project obstetric lead and Trustee MCAI, treating a patient on the maternity ward

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Abbreviations

ALSG	Advanced Life Support Group
APH	Ante Partum Haemorrhage
BMHC	Brikama Major Health Centre, The Gambia
CEmOC	Comprehensive Emergency Obstetric Care (WHO defined)
C/S	Caesarean section
EFSTH	Edward Francis Small Teaching Hospital
GMDC	Gambian Medical and Dental Council
IUFD	Intrauterine Fetal Death
MMR	Maternal Mortality Ratio
MCAI	Maternal and Childhealth Advocacy International
MoHSW	Ministry of Health and Social Welfare The Gambia
MVA	Manual Vacuum Aspiration
PPH	Post Partum Haemorrhage
RCH	Reproductive and Child Health Unit, The Gambia
SEC	Strengthening Emergency Care (MCAI Programme)
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Emergency Fund
WHO	World Health Organisation

Executive Summary

For 11 years, the Reproductive and Child Health (RCH) unit of the Ministry of Health of The Gambia, together with WHO and UNFPA, have been working in partnership with MCAI and ALSG to facilitate the Strengthening Emergency Care programme for pregnant women, babies, and children in The Gambia. However, maternal mortality is still a major problem, particularly in rural areas where there are few skilled obstetric practitioners.

In response to this situation, in August 2014, MCAI and ALSG initiated the Brikama Obstetric Project, an intervention consisting of an advanced obstetric training programme in which 3 international obstetricians provided almost continuous senior obstetric cover for Brikama Major Health Centre (BMHC) while training 6 obstetric trainees (4 junior doctors and 2 senior midwives) over 2 years. Health system strengthening to improve the service delivery of obstetric care has also been a major component of the project, particularly given the major challenges that had to be overcome at the start of the project, given the poor condition of BMHC and the lack of essential medicines and equipment.

The first year of the Brikama Obstetric Project demonstrated that it is possible to train doctors and senior midwives to a level where they can provide high quality Comprehensive Emergency Obstetric Care (CEmOC) in one year. The second-year of the Project will finish at the end of October 2016 but as yet, the project has no further funding to be able to continue after this time and therefore, will have to stop unless further substantial funding can be secured.

MCAI conducted an interim analysis of the effect of the Brikama Obstetric Project (the intervention) on maternal mortality, the clinical management of women experiencing maternal complications and life-threatening conditions, the functionality of BMHC and the ability of the unit to provide Comprehensive Emergency Obstetric Care. MCAI also assessed the situation regarding intra-uterine fetal deaths (IUFDs). Routinely collected data on neonatal outcomes has only just started.

Unfortunately, there was limited data on maternal mortality at BMHC before the intervention making an accurate comparison between the periods before and during the intervention impossible. There was no data available for the whole of 2013 and the unit's Death Registration Book only had data for 5 months of 2014, although some information could be gathered from other sources. The data for 2015 (the intervention period) was more complete.

There were 6 maternal deaths at BMHC in the limited periods in 2014 where data was available and 8 maternal deaths for the whole of 2015. In 2014, there were 9 maternal deaths following transfer from BMHC to EFSTH and 6 such deaths in 2015. Of note, however, is that the quarterly written returns to the Ministry of Health and Social Welfare for 2014 had listed that there were no in-facility maternal deaths at BMHC in 2014. Clearly this statement must have been an administrative error and if subsequently used to compile national or international mortality data, is cause for concern.

A retrospective case note review to identify all women experiencing maternal complications and life threatening conditions using WHO criteria for 4 months (1st April to 31 July 2015) during the intervention period, revealed that during this time, 124 patients admitted to the maternity unit had, or developed, a serious complication and 162 women had a potentially life-threatening condition. Almost every serious complication of pregnancy or delivery was managed according to evidence-based guidelines and protocols established as part of the intervention. For example, of the 37 women with severe PPH, 4 had missing case notes but all remaining 33 cases received appropriate utero-tonic drugs and other treatments such as removal of retained products, condom catheter or hysterectomy. There were no deaths following severe PPH. For 30 women with significant APH, all cases were managed appropriately although 6 had to be transferred to EFSTH because neither the operating theatre or an anaesthetist were available. For 62 women with severe pre-eclampsia, all cases were appropriately managed although one died at EFSTH after transfer. All 15 patients with eclampsia were managed appropriately with magnesium sulphate and antihypertensive drugs. None died. Ten of 11 patients with severe sepsis were treated with intravenous antibiotics. The remaining case had no notes. One patient died at BMHC having been admitted critically ill with a severe chest infection.

The trainees provided much of the clinical management, providing evidence of the effectiveness of the educational component of the project, further demonstrated by the high educational achievements attained by each trainee and the range of obstetric procedures that they have been trained to perform, as demonstrated in the outcomes of their examinations and each of their logbooks. Much of this care was, however, only achieved because of the availability of essential drugs such as oxytocin and essential surgical supplies, such as sutures, provided by MCAI. Although inappropriate to extrapolate the findings from a 4-month period to the whole of 2015, the findings suggest that over 500 women in the Brikama area could experience maternal complications and life-threatening conditions in a single year highlighting the priority to ensure that Comprehensive Emergency Obstetric Care is continuously provided at BMHC. All the serious complications that occurred could have resulted in maternal death without appropriate clinical management.

There is strong evidence of the improved functionality of BMHC to provide comprehensive emergency obstetric care. The use of the operating theatre for maternity cases increased from 73 cases in 2014 to 275 in 2015. This positive development demonstrates the effectiveness of the intervention, which has led to the capability of BMHC to safely manage many cases that would previously have needed transfer out to Edward Francis Small Teaching Hospital (EFSTH). A 38% reduction in transfers from BMHC to EFSTH between 2014 and 2015 (from 456 referrals to EFSTH in 2014 to 284 in 2015) further validates the effectiveness of the intervention. Furthermore, 6.1% of women delivering a baby (dead or alive) during the 4-month period 1 April to 31 July 2015 received a blood transfusion, a signal function of emergency obstetric care.

Assessment of birth outcomes highlighted the high number of IUFDs at BMHC. The high rates (34/1000 deliveries in 2014 and 44/1000 deliveries in 2015) is higher than the 26/1000 deliveries recorded for The Gambia in 2011. These high numbers are further supported by the results of the 4-month case study (1 April to 31 July 2015), which showed that a third of high risk deliveries at BMHC resulted in a fetal death. These findings clearly show the need for improved antenatal care, which will be a future priority of the Brikama Obstetric Project.

This interim analysis provides evidence to make a strong case for the continuation of the Brikama Obstetric Project with an appropriate level of funding. MCAI is currently devising a plan for the necessary funding required.

The paucity of neonatal data in this study, demonstrates the lack of attention given to neonatal care to date. Many babies are dying unnecessarily at BMHC because of the lack of a proper neonatal service and a large number of babies and mothers are referred to EFSTH because of this lack of neonatal care. Moving forward, any future plans should involve a comprehensive intervention [health system strengthening (including building a neonatal unit) with service delivery and continued apprenticeship based training] similar to that for obstetrics. MCAI is currently devising plans for such a programme with estimated costs.

MCAI and ALSG continue to believe that, not only is task shifting the way forward for the Gambia, but is also more likely to attract the funding urgently required for the obstetric and proposed neonatal projects.

Introduction

For 11 years, the RCH unit of the MoHSW of The Gambia, together with WHO and UNFPA have been working in partnership with MCAI and ALSG to facilitate the Strengthening Emergency Care (SEC) programme for pregnant women, babies, and children in The Gambia. This productive project has included renovations and rebuild to 3 major health centres (Basse, Essau and Brikama) and almost one thousand health professionals trained in skills to enhance emergency obstetric, neonatal, paediatric and major trauma care.

Despite the SEC programme, and other initiatives over this period, maternal mortality is still a major problem, particularly in rural, as compared to urban, areas of the country. In addition, there is a recognized paucity of skilled obstetric practitioners in the Gambia, especially in rural areas.

In response to this situation, in collaboration with the MoHSW, a pilot Advanced Obstetric Training Programme was initiated as an additional component to the SEC programme and based on the model successfully piloted in Liberia by MCAI and ALSG. An essential component of this programme was the continued strengthening of clinical and clinical-support systems in the maternity unit and operating theatre at BMHC to enable effective training and service delivery.

The Brikama Obstetric Project (the intervention), consisting of the advanced obstetric training programme plus the strengthening of obstetric care (including improved service delivery) commenced in August, 2014. Over the subsequent 15 months, 3 international obstetricians were involved in providing almost continuous senior obstetric cover for BMHC and training to the first two obstetric trainees (1 junior doctor and 1 senior midwife). With the support of the MoHSW, a further 4 trainees (1 senior midwife and 3 junior doctors) started the advanced obstetric training programme on 2nd November 2015. The second group of trainees are currently working at BMHC, with a continuous supervisory and training presence provided by senior international obstetric MCAI volunteers with support from the two previous trainees, a senior Gambian surgeon (who is also benefiting from the training), a Cuban gynaecologist, and for 4 weeks, a Nigerian obstetrician resident in The Gambia.

The second-year of the Brikama Obstetric Project will end at the end of October 2016 but as yet, the project has no further funding to be able to continue after this time and therefore, will have to stop unless further substantial funding can be secured.

In this report, we describe the Brikama Obstetric Project and present the interim outcome data.

The Brikama Obstetric Project (the Intervention)

Aims of the Brikama Obstetric Project

The primary aims of this MCAI and ALSG project are to reduce maternal morbidity and mortality in the Brikama region and eventually beyond by:

- Enabling the provision of high quality Comprehensive Emergency Obstetric Care (CEmOC) at BMHC by strengthening the health systems and service delivery

- Training doctors and senior midwives in Advanced Obstetric Practice to be deployed in major public health hospital facilities, such as BMHC and other rural facilities with similar skill gaps.

At present under Gambian legal regulations, senior midwives can be trained in all aspects of advanced obstetric care with the exception of caesarean section and other abdominal surgical obstetric operations.

The aims of the project are in line with the stated goals of 'The National Health Policy of The Republic of The Gambia 2012 – 2020 (Republic of the Gambia, 2012)' in which a clear commitment is made to:

- Extending access to comprehensive emergency obstetric care 24 hours a day 7 days a week
- Addressing the inadequate number and inequitable distribution of health care professionals within the country.

The aims of the project are also in line with the objectives of MCAI and ALSG, the GMDC, the WHO and UNFPA, and as such, all major stake-holders in maternal health within The Gambia share a commitment to achieving these goals.

The Rationale for the Brikama Obstetric Project

MCAI and ALSG first started working at BMHC at the request of the MoHSW in 2005. Up to 2011, achievements included the construction of an operating theatre, a new 6 bedded labour and delivery ward, numerous items of emergency equipment such as oxygen concentrators, pulse oximeters, theatre equipment including operating table, lights, suction systems and much more. As a result of the SEC programme's training of health professionals within facilities as well as the traditional birth attendants in the community, the implementation of an emergency ambulance system, and the major support of the RCH unit, the number of deliveries at BMHC increased from around 2000 in 2008 to around 5000 per year by 2011.

Despite these improvements, Gambian doctors were unwilling to work in obstetrics at BMHC and therefore the operating theatre was rarely used until the implementation of this new Brikama Obstetric Project. The standard of obstetric care and the morale of the midwives at BMHC had deteriorated as a result of gross understaffing and inadequate medical support in the face of a large increase in patient numbers. In August 2014, at the start of the Brikama Obstetric Project, BMHC was the busiest maternity unit in the country, with approximately 5000 deliveries/year, staffed by only one Cuban Gynaecologist.

BMHC has many features of an ideal training centre: it has the largest number of deliveries of any health facility in the country and therefore provides a rich case mix for training. In addition, it is in a relatively central and accessible part of the country, which has advantages for ensuring access for trainees and trainers. It also serves a largely poor population, who will greatly benefit from an improved obstetric service.

Challenges at the start of the Brikama Obstetric Project

At the start of the Brikama Obstetric Project, BMHC was an extremely under-resourced and poorly functioning unit that was struggling on multiple levels to care adequately for the large number of patients who attended. It was also unsuitable for training without considerable improvements in the clinical care pathways, staffing (particularly doctors or midwives trained in advanced

obstetrics) and availability of basic essential equipment, surgical materials and essential drugs. There was a serious lack of adequate anaesthetic input, as well as inadequate numbers of nursing and ancillary staff.

The main problems with the maternity unit at the start of the programme, observed by international MCAI obstetricians, are summarised in Box A below. For the full details, please see Appendix 1 (List of challenges at the start of the Brikama Obstetric Project).

Given all of these problems, to overcome these challenges it was necessary for the Brikama Obstetric Project (the intervention) to comprise multiple components of health system strengthening, including health service delivery, in addition to the training in advanced obstetric training.

Box A: Challenges at the start of the Brikama Obstetric Project

Maternity Unit

Clinical Care

- Inadequate monitoring and observation of patients
- No system for proactively managing patients
- Inadequate hand-over between shifts
- Complete absence of patient care pathways
- Gross under-staffing
- Operating theatre not functional
- All critical and high-risk patients referred an hour by ambulance to Edward Frances Small Teaching Hospital (EFSTH) in Banjul, often without stabilization and after significant and life-threatening delays
- No neonatal unit or ability to provide basic neonatal care

Stock Systems and Availability

- Frequent stock-interruption of essential life-saving drugs and materials for the labour ward including, oxytocin, misoprostol, hydralazine, nifedipine, all commonly used antibiotics, adrenaline, frusemide, diazepam, lignocaine.
- Frequent stock interruption of essential life-saving drugs and materials for the operating theatre including anaesthetic drugs, sutures, surgical haemostatic gauze; urinary catheters.
- Inadequate systems for stock-checking and replenishment of essential consumables both at unit and regional level

Environment and Organisation

- Extremely disorganized and dirty environment, including a cockroach infestation, frogs and cats on the ward, no formal paperwork, and unsafe, incorrect and disorganised sterilization and disinfection regimes.
- Maintenance problems that frequently left the unit without working sinks, toilets and electric power.
- Unsafe electrical equipment
- Inadequate storage facilities for unit's consumable goods
- A seriously damaged maternity ward roof that allowed torrential leaking during the rainy season
- No "on-call" accommodation suitable for obstetric trainers or trainees
- No functional washing machines in the laundry so blood stained drapes washed by hand.

Description of the Intervention

The intervention has 2 components 1) Health system strengthening with improved health service delivery and 2) An advanced obstetric training programme.

1) Health System Strengthening with improved health service delivery

Improvements to health system strengthening and health service delivery through multiple interventions were required immediately to enable the maternity unit to provide adequate care and function in a way conducive to training. While some of these interventions implemented by MCAI were 'one-off 'actions, most, such as ensuring adequate staff cover and a constant supply of drugs and medical supplies, are continuous activities. The comprehensive list of all implemented interventions to improve health system strengthening and health service delivery are listed in Appendix 2 (List of health system strengthening interventions and improvements) and also summarised below.

Clinical staffing: Improvements to clinical staffing include improved nursing and anaesthetic cover, organisation of a continuous on-call rota and on-call financial incentives provided to senior midwife graduates and trainees and also theatre orderlies to enable 24/7 theatre coverage.

Clinical organisational improvements: The introduction of daily handovers and ward-rounds; patients tracking and monitoring systems; regular observation rounds; clear written clinical guidelines; a triage system; and an ultrasound dating service and a medical antenatal clinic for women with high risk pregnancies.

Operating theatre: In addition to continuous staff cover, improvements to the operating theatre included initial fumigation. The operating theatre re-opened in December 2014 and in the following year had a significant increase in activity, despite frequent interruptions. The wide range of obstetric procedures performed was adequate for training and resulted in a reduced need for referral to EFSTH. A stock system has been introduced and established and surgical equipment provided and organised.

Stock-control system improvements: these include introducing and establishing regular stock checks and consumptions records for drugs and consumables in the maternity unit and operating theatre. A system for ordering safe and reliable medicines from the private market when unavailable from the MoHSW has also been established.

Drugs and materials continuously provided through MCAI as no supply from MoHSW: The long list of materials included the regular but intermittent provision of sutures, surgical gauze, povidone iodine and chlorhexidine surgical preparation, bleach, foley catheters, and urinalysis sticks. The long list of drugs needed included the continuous provision of ceftriaxone, intramuscular tramadol, rectal diclofenac, misoprostol, adrenaline, nifedipine and atenolol.

Drugs and materials regularly supplemented by MCAI because of an intermittent supply from the MoHSW: These include the regular but intermittent provision of large bore IV cannulae and spinal needles in addition to a long list of drugs such as oxytocin, hydralazine, lignocaine, metronidazole, ephedrine, dexamethasone, suxamethonium and marcaine/lignocaine for spinal injections.

Basic organisational improvements: These improvements include providing customized forms including structured initial assessment, continuation sheets, lab-request forms, observation charts,

prescription charts, blood transfusion forms, operation notes and follow-up slips. Provision of whiteboards help to co-ordinate patient flow, monitoring, and clinical management and bed clipboards ensure that paperwork remains with each patient.

Basic improvements to the environment: These improvements include deep cleaning to rid the wards of cock-roaches, the provision of curtains between ward beds to provide privacy, installation of a gantry above all labour ward beds for the hanging of IV fluid and blood, and the provision of high quality re-usable aprons for use of by staff during procedures and deliveries.

Improvements to sterilisation systems: These improvements include establishing a sterilization area with visual standards for dry-heat sterilization and high-level disinfection for the labour ward and for the operating theatre and training all staff in the process of dry-heat sterilization.

Improvements to maintenance support: this long list includes rewiring and replacing unsafe electrical sockets, frequent plumbing repairs and repairs to electrical faults in the labour ward and operating theatre, and training for the unit logistician in a variety of maintenance techniques.

Major Maintenance projects: These include successful advocacy by MCAI for the UNFPA to repair the maternity unit roof through the MoH regional health team, renovation of the doctors on-call room, and renovation of a maternity unit room to create a maternity triage system.

Equipment: MCAI has provided a long list of labour ward equipment for the labour ward and operating theatre including a portable ultrasound scanner, 4 pulse oximeters, 8 doppler ultrasound machines, 12 blood pressure machines, 5 Manual Vacuum Aspiration kits, a Caesarean section set, multiple surgical instruments, and theatre drapes. Other items include a large washing machine for laundry and multiple maintenance tools, such as drills.

Significant support is required to maintain these established improvements and ensure that the Brikama Obstetric Project remains feasible.

2) The Advanced Obstetric Training Programme

This component of the Brikama Obstetric Project is based in the maternity unit at BMHC and is delivered by international senior MCAI obstetricians.

Following the start of the programme in August 2014, there was a need to obtain a licence from the Gambian GMDC for the international obstetricians to be permitted to practice in BHMC, and for essential equipment and drugs to be provided and clinical guidelines to be introduced before the training programme began. From the 1st October 2014 to 31st December 2014 there was an introductory period where major improvements to the maternity unit continued to be put in place.

From 1st January 2015 there has been at least one senior obstetric trainer providing training at BMHC, ensuring continuous training and supervision of the trainees (except a period of 10 days in May 2015).

The Advanced Obstetric Training Programme is summarised below but for more details please see Appendix 3 and please see objective 4 for educational attainments of trainees.

The Advanced Obstetric Training Programme is a one year apprenticeship-style and competency-based programme with a varied and comprehensive curriculum. Clinical sections cover diagnosis

and treatment of obstetric problems including emergencies, surgical skills and the use of ultrasound. In addition, trainees gain experience in service management tools such as audit, writing guidelines, root cause analysis and contributing to in-house training.

The Programme begins with a **two week Foundation Course** in which trainees are taught the management of obstetric emergencies; basic surgical skills; principles of ultrasound scanning as well as relevant anatomy and physiology. The programme includes lectures, practical skills teaching and simulation of emergency situations such as massive post-partum haemorrhage and shoulder dystocia.

The remaining fifty weeks of the programme are delivered by **apprentice-style training**. Trainees work in the maternity unit providing clinical service supervised by international senior obstetricians, a senior Gambian surgeon, a Cuban gynaecologist and for the second year of training by the doctor and senior midwife who had completed the first year of the programme.

Each trainee is required to demonstrate competence in each area of the curriculum before successful graduation. Each trainee maintains a logbook of all procedures, uses formative work-place based assessments, and completes assignments including an audit project and writing a guideline. Where there are clinical problems not covered during the training, written assignments are used.

The trainees are also taught to recognize, stabilize and refer those women who require tertiary level care in a safe effective manner.

Trainees work alongside trainers to deliver care within their competence. Initially, all clinical care is supervised directly, then, as trainees become competent in areas of the curriculum, they work more independently with reference to trainers as needed.

The main clinical areas used for training are:

The 6 Bedded Labour ward for intrapartum care and the management of critically ill women
Trainees are usually the first obstetrician and manage the patients within their competence. Patients are reviewed with senior doctors/advanced midwives and a definitive management plan is put in place. This allows a discussion as to the reasons behind decision making. Trainees then implement the management plan with the midwives. Any practical procedures are performed by trainees under direct supervision or by trainers with assistance by the trainee if too technically difficult.

Trainees are also required to have situational awareness regarding the patients on the labour ward including potential complications and management of resources such as access to the operating theatre particularly during busy periods.

When critically ill patients are managed on labour ward, the trainees work closely with trainers and supervise midwives to ensure care is delivered in a timely manner.

There is a multidisciplinary handover meeting each morning led by the on call trainee with support from trainers. Trainees are required to formally handover care before leaving the labour ward.

Trainees are responsible for maintenance of the emergency boxes and supporting the systems within the unit.

The maternity wards:
There is a daily ward round with a trainee and trainer for all in-patients. As the trainees gain confidence and become competent they are able to carry out these ward round alone and discuss cases with trainers.

There are standard management plans such as a post-operative recovery protocol to guide management and trainees are taught to anticipate, look for, and manage complications as early as possible.

The Triage area:
There is a midwife-led triage area for review of women with problems in pregnancy. The trainees review patients with obstetric complications, discuss or review with a trainer, form a differential diagnosis and implement a management plan. This work may include admission or outpatient management.

The Operating Theatre:
As agreed with the MOHSW, only doctors are trained in abdominal surgery although senior midwives undergoing training are also able to perform complicated perineal repairs and Manual Vacuum Aspirations (MVAs).

Once trainees have demonstrated competence in basic skills such as knot tying, they are taught to perform caesarean section, bilateral tubal ligation and other abdominal surgery under direct supervision. Once competent they are assisted by another trainee with the trainer in theatre and then via less direct supervision. All theatre cases are discussed with a trainer before proceeding and trainers are available should complications arise. Where operations are technically difficult, trainees assist and discuss cases.

The antenatal clinic and transabdominal ultrasound room:
The antenatal clinic is a doctor/advanced midwifery-led service for antenatal management of pregnancy complications and ultrasound dating of pregnancy. The trainees take a brief history and review antenatal management, perform ultrasound scan, and formulate a management plan. They are directly supervised until deemed competent for each part of the ultrasound assessment then save images to be reviewed online by an international trainer to confirm ongoing competence. Any images of possible fetal anomaly are reviewed in the weekly ultrasound meeting.

Out of Hours Cover
The junior trainees work 1:4 rota with prospective cover with 24 hour on call. They are expected to work throughout the night if needed so have an on call room available and are off duty on the day after their on call. The operating theatre and team are available 24/7 and trainees either perform or assist in all theatre cases.

There is a 1:4 senior rota with a Cuban gynaecologist, senior Gambian general surgeon who is also completing the obstetric training, and the first two MCAI trainees. An international trainer is available when required.

Curriculum
The curriculum consists of ten modules. Modules 1 and 2 are delivered during the Foundation programme with the remainder during the apprenticeship style training.
Modules:

1. Anatomy and Basic Surgical Skills

2. Human Physiology and Physiological Adaptations in Pregnancy
3. Antenatal Care
4. Maternal Medicine
5. Management of Early Pregnancy Complications
6. Clinical Management Labour and Delivery and their complications
7. Organisation and management of the labour ward
8. Postpartum Management (Including Post-operative care)
9. Ethics and professional standards
10. Laboratory and Blood Transfusion

The detailed learning objectives to be achieved are described within each module. The majority of the learning objectives are expected to be encountered during the clinical training. The remaining areas are taught via case discussions, tutorials, further reasoning and simulations.

Methods for assessing the educational programme (for educational attainment results please see later in this report):

1. *Foundation Programme:*

Assessment of the Foundation Programme is via a summative assessment composed of a 3 station OSCE and a short-answer question paper and a 'spot' (anatomy identification) station.

Trainees are expected to achieve a pass mark in this examination before proceeding to apprenticeship styled clinical work. Failure would result in remedial teaching and re-testing in the first instance, and recommendation for removal from the training programme if a "pass" was not achieved at the second sitting.

2. *Apprentice Style Training:*

The trainees must demonstrate competence in each area of the curriculum. This is achieved using several formative work-place based assessments, a clinical/surgical log-book and written assignments and presentations.

Logbooks:
The trainees produce a log of all the procedures they have performed or assisted in. This log is then reviewed with and signed off by the international trainer.

There are three documents used to record other aspects of training:
1. Case based discussions: to demonstrate knowledge of core curriculum elements and interesting cases
2. Supervisor observed experience: to record clinical experience not suitable for the log book such as management of a critically ill patient
3. *Reflective practice*: to record and reflect on cases with a poor outcome and reflect on possible changes in practice for the future.

All these are reviewed, and discussed and signed off by a senior obstetric trainer.

Written assignments:
Trainees are required to write an evidence based guideline tailored to local resources and perform an audit of a previously implemented guideline. These are written under supervision of an international trainer and have to be approved by the senior staff in the unit.

Answers to written questions are used to demonstrate knowledge in areas not encountered in clinical practice in BMHC.

Progress to date in the advanced obstetric training programme

The successful pilot of MCAI's Advanced Obstetric Programme demonstrated that it is possible to train doctors and senior midwives to a level where they can provide high quality Comprehensive Emergency Obstetric Care in one year.

In the first period of the training (October 2014 to May 2016), two trainees, recommended for the programme by the MoHSW, successfully completed the training: one doctor and one senior midwife. Training for the first two trainees was extended beyond the first year due to the need to establish other elements of the project and bring clinical care to an acceptable, basic standard.
In a continuation of the Programme, 4 more trainees (3 doctors and 1 senior midwife) commenced the Advanced Obstetric Training Programme in October 2015 and are scheduled to complete training in October 2016. The doctors were all recruited following recommendation by the MoHSW and successfully completing an interview process. The senior midwife was appointed after responding to a nation-wide job advertisement and a competitive interview process.

The presence of international senior obstetricians, and later, the obstetric trainees, has also provided the opportunity to provide some teaching to the unit's midwifery staff. There are currently plans to expand this process to include the introduction of mandatory training days. In addition, all staff receive work-place based training through a daily educational multi-disciplinary hand-over meeting.

Evaluation of the Intervention

Although the Brikama Obstetric Project is continuing until October 2016 when funding runs out, MCAI has conducted an interim analysis to evaluate the effectiveness of the Project (with both its health system strengthening and training in advanced obstetrics components) to date in reducing maternal mortality and improving the clinical management of women experiencing life-threatening obstetric complications.

The interim analysis also aimed to evaluate the effect of the intervention to provide Comprehensive Emergency Obstetric Care at BMHC. The effectiveness of the Advanced Obstetric Training component of the intervention was also evaluated by assessing educational attainments of the trainees. Unfortunately, because of limited data collection, it was impossible to formally evaluate the impact of the intervention on neonatal mortality and morbidity. However, in a baseline assessment, the situation regarding IUFDs at BMHC was assessed.

The full details of the interim analysis (the study) are presented here.

Study Objectives
This interim analysis had the following 4 objectives:

1) To determine maternal mortality at BMHC before the Brikama Obstetric Project (the intervention) and for the first year of the implemented, on-going intervention (1st January 2015 to 31st December 2015). For the purposes of this study, maternal deaths were classed as any death occurring in women delivering live or stillbirth babies or death occurring in any woman with a complication of pregnancy.

2) To identify and review all cases of women experiencing life-threatening complications of pregnancy (maternal mortality near misses as identified by WHO 'near miss' criteria) for 4 months (April 1st 2015 to July 31st 2015) during the intervention period and to assess whether each individual woman (case) had been managed appropriately as per management protocols.

3) To measure improved function of the maternity unit at BMHC in providing Comprehensive Emergency Obstetric Care by reviewing routinely recorded data on the operating theatre and its use and the number of referrals (transfers) from BMHC to Edward Francis Small Teaching Hospital in Banjul. In addition, the use of blood transfusions was also assessed from the 4 month period selected for the Maternal Mortality Near Misses (April 1st 2015 to July 31st 2015).

4) To assess the educational attainments of the trainees in the Advanced Obstetric Training Programme to provide supportive evidence of their ability to provide Comprehensive Obstetric Emergency Care.

5) To assess the situation regarding intra-uterine fetal deaths by reviewing routinely collected data on birth outcomes before and during the intervention and by using information collected in the 4-month maternal "near miss" period (April 1st 2015 to July 31st 2015).

Objective 1: Effect of the intervention on maternal mortality

Methods

The following time periods were examined for maternal deaths:
1) The whole of 2013 until 31 July 2014, a 19 month period before the introduction of the intervention

2) 1 st August to 31st December 2014, which comprised of Phase I and Phase II of the introductory period of the intervention. In Phase I, two international MCAI obstetricians arrived at BMHC and began to introduce some of the health system strengthening components of the intervention but were unable to provide additional health service delivery or commence the training in advanced obstetrics because they were not yet licensed by the GMDC. In Phase II from 1st November 2015, all three components of the intervention were gradually being introduced but were not yet fully implemented.

3) The whole of 2015, when all components of the programme continued to be developed and implemented and the clinical structure was considered adequate to enable training. Notably, there were problems with the health service delivery during this time including: partial anaesthetic cover for the entire year varying from day time only cover to 3 days/week only; a long period (6th August to 1st December 2015) in which Cuban doctors were not in country and so the obstetric service at BMHC was entirely run by a single MCAI Obstetrician and trainees, and the complete closure of the operating theatre during repair of the maternity ward roof. This repair, which could have been completed in two weeks, actually took two months, and required that all ward patients be cared for in unsuitable and extremely cramped conditions on the opposite side of the health centre to the labour ward (from Aug-October). MCAI staffing improved from 23/10/15 to facilitate training the new group of trainees.

During these 3 time periods, maternal deaths were categorised in the following 4 ways:
1) Maternal deaths at BMHC (facility deaths)

2) Maternal deaths after discharge home from BMHC (community deaths)
3) Maternal deaths during transfer from BMHC to Edward Frances Small Teaching Hospital
4) Maternal deaths after transfer from BMHC to EFSTH.

Maternal deaths were identified by:
1) Discussions with staff who were working at BMHC before and/or during the intervention period
2) Examination of the death certificate books at BMHC
3) Examination of the Labour Ward Mortality Book at BMHC
4) Discussion with Public Health Officers
5) Review of information held on Maternal Mortality cases at EFSTH
6) Review of the BMHC Transfers-out book
7) Review of the BMHC Theatre Cases book.

For EFSTH, the Chief Medical Officer and Medical Records Manager provided access to a database of maternal deaths occurring at the facility in 2014 and for the first 9 months of 2015 (at the time of obtaining the data, the database at EFSTH was yet to be updated and confirmed with data for October, November and December 2015). This database provided details of the reason for transfer and the cause of death.

To help provide context, the number of maternal transfers out from BMHC to EFSTH were recorded for both 2014 and 2015.

With the information collected, efforts were made to calculate Maternal Mortality Ratios (MMR) for 2014 (the 7 months before the intervention and the introductory period of the intervention) and 2015 (the fully-implemented period of the intervention).

Results

The data review process highlighted important gaps. There was no community data available for any time period as maternal mortality in the community is not routinely recorded. It was therefore not possible to review maternal deaths after discharge home from BMHC (one of the planned categories of the maternal death review).

In-facility deaths

The whole of 2013

There was no facility death certification registration book available at BMHC for the whole of 2013, nor were there any entries of maternal deaths in the Labour Ward Mortality book for 2013. Therefore, it was not possible to identify any maternal deaths for 2013.

The data review process revealed that a process to collect and record maternal mortality data was not instigated until early in 2014. Furthermore, maternal deaths at BMHC in 2014 were only partially recorded. There were no facility death certificate registration books available for two time periods: 1st January 2014 to the 22nd April 2014 and from 2nd July 2014 to 25 September 2014, meaning that there was no maternal mortality data available via this source for nearly 7 months of 2014. In-facility mortality data for this seven month period could therefore only be ascertained from the Labour Ward Mortality book or staff recollection. However, the Labour Ward Mortality book only had entries recorded for the first 3 months of 2014.

It is therefore highly likely that a number of maternal deaths occurred in BMHC in 2014, which were not recorded because of the limitations in recording maternal mortality as described above.

All the maternal deaths occurring in BMHC in 2014 **that could be identified** are listed in Table 1 and a brief description given of each where possible. As Table 1 shows, 6 cases of maternal death were identified in 2014 (including 1 death before arrival).

Given the lack of, and incompleteness, of the data, it has not been possible to measure the in-facility Maternal Mortality Ratio (MMR) in BMHC for the time period before the implementation of the intervention or to draw comparisons with the intervention period.

The maternal mortality data within BMHC for 2015 was more complete and there can be more certainty regarding its accuracy, as there were no periods where death registration books were missing. And although disparity between deaths recorded via the death certification registers and deaths recorded in the Labour Ward Mortality Register existed, any discrepancy was minimal. Maternal deaths for 2015 are also listed in Table 1 and a brief description given where possible. As Table 1 shows, there were 8 maternal deaths in BMHC for the whole of 2015 (including 1 death before arrival).

Table 1: Recorded Maternal Mortality Cases at Brikama Major Health Centre

2014 Recorded Maternal Mortality Cases at Brikama Major Health Centre				
Patient Number	**Age (yrs.)**	**Date of Death**	**Cause of death given**	**Further Summary detail (if available)**
1	?age	04.02.2014	Ruptured uterus	None available. Source of information: Labour Ward Mortality Book
2	?age	09.02.2014	Fluid in intra-abdominal cavity	None available. Source of information: Labour Ward Mortality Book
3	35	24.02.2014	Home delivery **Died before arrival to BMHC**	None available. Source of information: Labour Ward Mortality Book
4	17	03.03.2014	Severe anaemia: Haemoglobin 6g/dl	None available. Source of information: Labour Ward Mortality Book
5	?age	26.09.2014	Ruptured uterus/ hypovolemic Shock	None available. Source of information: Facility Death Certificate Book
The death below occurred during the introductory period of the project (October, November and December 2014) when systems were gradually put in place to strengthen emergency care				
6	28	30.10.2014	Haemorrhage/ shock Died in operating theatre (pre-op)	Admitted collapsed, gasping and with a terminal bradycardia at 30/40 gestation. Severe anaemia evident associated with abdominal distention. At time anaemia thought to be secondary to rupture/internal bleed, but subsequently felt to be due to severe malaria
	Total cases identified for 2014: 6 definite (including 1 death before arrival)			
2015 Recorded Maternal Mortality Cases at Brikama Major Health Centre				

Table 1: Recorded Maternal Mortality Cases at Brikama Major Health Centre				
	Age in yrs.	**Date of Death**	**Cause of death given**	**Further Summary detail (if available)**
7	25	01.01.2015	Postpartum Haemorrhage (PPH) Died intra-operatively	Massive PPH following a mid-trimester loss associated with sepsis. Condom tamponade failed, so taken to operating theatre for hysterectomy but died on operating table due to problems in obtaining blood for transfusion
8	32	18.06.2015	Septic shock, secondary to severe pneumonia	3 weeks post-delivery of a stillborn baby. Admitted with severe dyspnoea and abdominal pain, jaundice, tachycardia and pyrexial. Acute deterioration and died despite active management and eventual cardiopulmonary resuscitation. Too unstable to refer for intensive care at EFSTH.
9	35	07.08.2015	Pulmonary embolism/ cardiorespiratory failure 5 days post-delivery	None available – extensive unsuccessful search for records. Source of information: Facility Death Certificate Book
10	26	18.09.15	Sudden death /unknown Cause **Dead on arrival to BMHC**	G2P1 32 week's gestation (? twins). History of sudden collapse at home. Relatives recounted no known illness or complaint. There were no signs of violence, bleeding, or severe anaemia.
11	34	01.10.15	Amniotic fluid embolism or other embolism/ intracranial bleed	G7P6 Admitted at term with spontaneous rupture of membranes (thin meconium). Atypical convulsions during augmentation of labour. MgSO4 given. Significant tachycardia recorded prior to convulsions which persisted. IUFD identified. Hypotensive and patient then lost consciousness. Died despite resuscitation attempts.
12	38	15.10.15	Cerebrovascular accident/pulmonary embolism	Admitted unconscious, gasping and with oxygen saturations of 50%. Relatives gave classic history of possible pulmonary embolism (PE) and chest was clear therefore treated with low molecular weight heparin and O2 for presumed PE. Oxygen saturations recovered slowly to 80% but developed signs of an acute intracerebral event about 5 hours after admission and died shortly afterwards
13	34	03.12.15	Eclampsia	None available. Source of info: Labour Ward Mortality Book ONLY

Table 1: Recorded Maternal Mortality Cases at Brikama Major Health Centre				
14	19	15.12.15	Massive Acute Brain Injury, secondary to raised BP & Postpartum Haemorrhage. Hysterectomy post C Section	Severe pre-eclampsia at 36 wks gestation. Induction of labour (IOL), nifedipine and MgSO4 regime. No progress with IOL so emergency caesarean section. Massive PPH – actively managed. Needed hysterectomy & massive blood transfusion. Post operatively high BP, no urine output. Delayed management of hypertension. Condition further deteriorated – respiratory arrest and massive acute brain injury diagnosed.
	Total cases identified for 2015 : 8 deaths (including 1 death before arrival)			

Maternal deaths during and after transfer from BMHC to EFSTH

Table 2 lists the maternal deaths for the BMHC transfers-out to EFSTH during 2014 and 2015.

For 2014, there were 9 maternal deaths following transfers-out to EFSTH from BMHC. Of these, 2 were dead on arrival, 3 were close to death on arrival and died soon after, and a further 2 died on the date of transfer.

For 2015, there were 6 maternal deaths resulting from transfers-out to EFSTH from BMHC. None of these patients arrived dead and 2 died on the day of transfer.

The BMHC records for the patients who had transferred from BMHC to EFSTH and who had subsequently died were analysed for the first 9 months only of 2015 (it was not possible to obtain from EFSTH information for the last 3 months of 2015).

To put this information into context, further analysis (see Table 3) showed that the number of maternal transfers from BMHC to EFSTH in 2014 was 456 (out of 5311 live births) and in 2015 was 284 (out of 5183 live births). See the section on Objective 3 for further analysis and discussion.

Table 2: Maternal Deaths at Edward Frances Small Teaching Hospital (EFSTH) that were transfers in from Brikama Major Health Centre (BMHC).				
Patient Number	**Age in yrs.**	**Reason for transfer-in**	**Date and cause of death given**	**Further summary detail (if available)**
2014 Maternal Deaths at Edward Frances Small Teaching Hospital (EFSTH) that were transfers in from Brikama Major Health Centre (BMHC).				
15	35	Eclampsia/delay 2nd stage	15.01.2014 Eclampsia, disseminated intravascular coagulation (DIC) and respiratory failure	LSCS at EFSTH for obstructed labour and eclampsia. Died within 15 minutes of the operation.
16	25	Severe pre-eclampsia	20.01.2014 Severe pre-eclampsia	Patient died on date of transfer, no further information available.

Table 2: Maternal Deaths at Edward Frances Small Teaching Hospital (EFSTH) that were transfers in from Brikama Major Health Centre (BMHC).				
Patient Number	**Age in yrs.**	**Reason for transfer-in**	**Date and cause of death given**	**Further summary detail (if available)**
17	27	Delivered at BMHC and had postpartum haemorrhage	22.01.2014 **Dead on arrival at EFSTH** Hypovolemic shock	No further information available.
18	31	Hysterectomy performed at BMHC for abruption and uterine atony	26.01.2014 Abruption/ DIC Brought in unconscious	Patient died on date of transfer, no further information available.
19	30	Normal term delivery at BMHC following an abruption. Subsequent post partum haemorrhage and hypovolemic shock	04.02.2014 Post partum haemorrhage and DIC	Brought in gasping. Died on date of transfer.
20	26	Admitted to EFSTH from BMHC with ruptured ectopic pregnancy and hypovolemic shock	21.04.2014 Ruptured Ectopic pregnancy	10 minutes after arrival at EFSTH gasping and died on way to operating theatre for laparotomy. Died on day of transfer.
21	28	Sickle cell crisis in pregnancy/ acute pulmonary oedema	29.09.2014 Severe pre-eclampsia and sickle cell disease	Died 1 day post transfer in EFSTH intensive care unit
22	24	Post-partum Eclampsia	10.11.2014 Post-partum eclampsia and brain tumour	Died 14 days post transfer on intensive care unit
23	26	2 previous caesarean sections 28 weeks pregnant	10.11.2014 **Arrived dead ? cause.**	Arrived dead from BMHC
2014 Total transfers in to EFSTH from BMHC resulting in maternal mortality = 9 (including 2 who arrived at EFSTH dead; and 3 who were close to death on arrival and died soon after; and a further 2 who died on the date of transfer)				
2015 Maternal Deaths at Edward Frances Small Teaching Hospital (EFSTH) that were transfers in from Brikama Major Health Centre (BMHC)				
Patient number	**Age yrs.**	**Reason for transfer-in**	**Date of referral and cause of death given**	**Further summary detail (if available)**

Table 2: Maternal Deaths at Edward Frances Small Teaching Hospital (EFSTH) that were transfers in from Brikama Major Health Centre (BMHC).				
Patient Number	**Age in yrs.**	**Reason for transfer-in**	**Date and cause of death given**	**Further summary detail (if available)**
24	24	Puerperal sepsis	08.02.2015 sepsis and ? left ventricular cardiac dysfunction	2 weeks post-delivery on transfer in from BMHC. Died on intensive care unit one day after transfer. Given fluids, IV antibiotics and urinary catheter at BMHC prior to transfer to EFSTH for high dependency care
25	17	Severe pre-eclampsia, abruption, (intrauterine fetal death (IUFD) and blood clotting dysfunction	02.04.2015 Severe anaemia, severe preeclampsia. IUFD and disseminated intravascular coagulation (DIC)	Died 1 day post transfer from BMHC 35 weeks gestation. Blood pressure high at BMHC where given MgSO4 regime and hydralazine. Blood transfusion also given and induction of labour with misoprostol. After 2 doses of misoprostol, patient referred to EFSTH for further management.
26	20	Severe anaemia Obstructed Labour, needing caesarean section but no anaesthetist available at BMHC	09.06.2015 Anaphylactic transfusion reaction post caesarean section	Admitted in labour to BMHC, progressed to cervical dilatation of 9cm but subsequent failure to progress. Caesarean section (CS) performed at EFSTH. Patient died 1-day post transfer and post CS.
27	36	Severe hypoxic brain injury	12.08.2015	For caesarean section given spinal anaesthetic. However, high spinal complication lead to respiratory arrest and anaesthetist could not ventilate the patient for a prolonged period
28	39	Fetal distress	24.09.2015 Emergency caesarean section at EFSTH Cardiac arrest on arrival in the intensive care unit at EFSTH, considered secondary to maternal exhaustion and IUFD	Reasons for transfer from BMHC given as fetal distress, uterine rupture and intra-uterine infection. Caesarean section at EFSTH on day of transfer from BMHC. Unable to find notes to review BHMC management

Table 2: Maternal Deaths at Edward Frances Small Teaching Hospital (EFSTH) that were transfers in from Brikama Major Health Centre (BMHC).				
Patient Number	**Age in yrs.**	**Reason for transfer-in**	**Date and cause of death given**	**Further summary detail (if available)**
29	32	Pregnancy induced hypertension (PIH), prolonged labour and anaemia	24.09.2015 Postpartum haemorrhage, postpartum eclampsia and severe anaemia	Referred to BMHC from minor health centre in early labour and with raised BP and anaemia (Hb 7.1g/dl) Cervix was 7cm dilated on admission. Artificial rupture of membranes (ARM) performed and oxytocin four hours later as no progress. After further 4 hours still no progress, so transferred to EFSTH. Patient had been given nifedipine at the minor health centre for raised BP, but BP not above 140/100 while at BMHC and no proteinurea. Died one-day after transfer from BMHC. Underwent emergency caesarean section at EFSTH for obstructed labour (CPD) and PIH. Post caesarean section transferred directly to ICU where she died.
2015 Total Transfers in to EFSTH from BMHC resulting in maternal mortality = 6 (none of these patients arrived dead x 1 died on the day of transfer) **PLEASE NOTE THAT NO INFORMATION WAS PROVIDED FROM EFSTH FOR 1ST OCTOBER TO END DECEMBER 2015**				

Table 3: Maternity referrals from BMHC to EFSTH January 1st 2014 to December 31st 2014 & from January 1st 2015 to December 31st 2015			
Month	**Year**	**No. referrals of maternity patients to EFSTH from Brikama**	**No: deliveries at Brikama MHC**
January	**2014**	**45**	**537**
February	**2014**	**28**	**474**
March	**2014**	**33**	**491**
April	**2014**	**34**	**464**
May	**2014**	**32**	**347**
June	**2014**	**35**	**311**
July	**2014**	**34**	**299**
August	**2014**	**38**	**344**
September	**2014**	**52**	**486**
October	**2014**	**42**	**568**
November	**2014**	**52**	**501**
December	**2014**	**31**	**489**
TOTAL	**2014**	**456**	**5311**
January	**2015**	**17**	**503**
February	**2015**	**17**	**454**
March	**2015**	**19**	**456**

Table 3: Maternity referrals from BMHC to EFSTH January 1st 2014 to December 31st 2014 & from January 1st 2015 to December 31st 2015			
Month	**Year**	**No. referrals of maternity patients to EFSTH from Brikama**	**No: deliveries at Brikama MHC**
April	**2015**	**17**	**444**
May	**2015**	**38**	**387**
June	**2015**	**36**	**316**
July	**2015**	**20**	**318**
August	**2015**	**12**	**348**
September	**2015**	**38**	**425**
October	**2015**	**39**	**499**
November	**2015**	**16**	**501**
December	**2015**	**15**	**532**
TOTAL	**2015**	**284**	**5183**
January	**2016**	**17**	
February	**2016**	**14**	
March	**2016**	**10**	

Comparison of combining in-facility (BMHC) and transferred-out maternal deaths (EFSTH)

As previously discussed, because of the lack of, and incompleteness of the data, it is not appropriate to make maternal mortality comparisons between the time periods before the intervention, during the intervention introduction period and the fully-implemented intervention periods.

From the limited data available, in the first 3 months of 2014, where there were 3 deaths in-facility at BMHC and 5 deaths after transfer-out to EFSTH. During this 3-month period there were 1452 live births at BMHC and 106 transfers to EFSTH. Analysis of this highly selected and limited data shows that there were 8 maternal deaths for 1452 *live births* during this period, giving an MMR of 551/100,000 live births.

Given the serious limitations of the data, these figures are the lowest possible for maternal mortality in the first 3 months of 2014 when there appears to be an attempt to record maternal deaths. These figures could be an under-estimate. It is, however, inappropriate to extrapolate these figures for the whole of 2014 or for the whole of the pre-intervention period it is possible that, by natural variability alone, deaths in the first 3 months of 2014 represented a natural peak in their incidence. Thus, as an illustration, examination of deaths occurring in the last 3 months of 2015, when there were no mortality data provided for transfers out to EFSTH, there were 4 deaths in BMHC (one more in BMHC deaths than in the first 3 months of 2014).

Analysis of maternal deaths during the first 9 months of 2015 (the fully-implemented intervention period but excluding the last 3 months where mortality data on transfers to EFSTH were not provided), shows that there were 3 maternal deaths at BMHC and 6 after transfer to EFSTH. During this 9 month period there were 3505 *live births* at BMHC giving an MMR of 257 /100,000 live births.

Discussion

The complete lack of maternal mortality data for 2013 is extremely concerning, especially as BMHC is the facility with the largest number of births in The Gambia. This lack of data perhaps reflects the low priority given to maternity care at that time.

Because of the major limitations of the data for 2014, it is difficult to infer any conclusions about the impact of the intervention on maternal mortality before or after the intervention.

Of note, however, is that although 5 definite cases of maternal mortality within BMHC were identified in 2014, the quarterly written returns to the Ministry of Health and Social Welfare for that year had listed that there were no in-facility maternal deaths at Brikama in 2014. Clearly this statement must have been an administrative error as there were cases occurring. If this return was subsequently utilised to compile national or international mortality data, the accuracy of the national data for this period would be of great concern.

For the fully-implemented intervention period (all of 2015) the in-facility mortality data available were more complete and therefore there can be greater reliance on the accuracy of maternal mortality numbers for this period. However, because of the high likelihood of missing cases for 2014, it is difficult to reach any safe conclusions about any difference between the in-facility maternal mortality rates for 2014 and 2015.

Examination of the 15 maternal deaths at BMHC over the 2 years 2014-2015 (Table 1) reveals that for 5 cases (numbers 3, 6, 8, 10 and 12) the mothers arrived at BMHC either dead or in extremis with very little hope of surviving no matter how good the obstetric care. In order to prevent such situations, as a matter of urgency, the population and primary health care workers, including Traditional Birth Attendants, in the Brikama region should be encouraged to ensure women with potentially life-threatening problems attend earlier at BMHC if they are experiencing a complication of pregnancy or delivery. MCAI had originally established an emergency ambulance transport system ('flying squad') for patients from the community to be able to be transferred rapidly to the maternity unit at Brikama 24 hours a day. These results suggest a possible need for this service to be considered as a component of an expanded maternity service at BMHC.

The natural variation in maternal mortality rates, poor antenatal care, and the delays in presentation of patients who are critically ill and therefore almost impossible to resuscitate, all contribute to making an accurate evaluation difficult. However, the introduction of monitoring systems to better record data and **efforts to encourage the local population and their health workers that, given the major improvements in BMHC, they should attend earlier if experiencing a complication of pregnancy or delivery,** might soon begin to provide evidence of an improved MMR as a result of the intervention.

The difference between the maternal mortality cases occurring at EFSTH after transfer-in from BMHC between 2014 and 2015 (Table 2) is more illuminating and suggests an improved level of care provision occurring in BMHC as part of the intervention.

In 2014 the period before the intervention, of the 9 transfers who died, 2 were dead on arrival at EFSTH, 3 were close to death on arrival and and an additional 2 died on the date of transfer. These results could suggest inadequate clinical stabilisation prior to transfer and/or inadequate care during transfer.

For the first 9 months of the 2015 intervention period, of the 6 transferred patients who died, none arrived dead at EFSTH and 4 died at 1 day after the transfer. The women who eventually died after transfer-in from BMHC to EFSTH were more likely to be stable on admission with their condition deteriorating at some point but not during the immediate day of transfer. These data for the 9 months of the intervention period is reassuring, suggesting that generally, patients were transferred from BMHC to EFSTH in a more stable condition.

Objective 2: Effect of the intervention on the management of women experiencing life-threatening complications of pregnancy (near misses for maternal death)

Methods

As recommended by WHO, a four month period was selected for reviewing all cases of near-miss maternal deaths/ life-threatening emergencies occurring in women delivering babies or in women experiencing complications of pregnancy. The four month period selected was April 1st 2015 to July 31st 2015 as this period represented a relatively stable period of service delivery following significant but ongoing improvements, and the presence of both trainees during an active period of the educational programme.

The cases were identified through a comprehensive, retrospective patient case note review conducted by two of the authors (WM and AC) with the help of four trainees in advanced obstetrics (see acknowledgements). Each case was identified and categorised using the WHO definition of Maternal Near Misses (see Box 1 below) . The WHO classification includes 4 categories and in some cases, the "near miss" event fell into more than one category.

Of note, the MCAI audit also included major antepartum haemorrhage (APH) and ruptured ectopic pregnancies as these conditions were frequently life-threatening, and fitted within the second and/or third WHO criteria (critical intervention and life-threatening conditions).

Two components of the 'critical interventions' category of WHO (interventional radiology and admission to an intensive care unit) were not available at BMHC. It was only possible to include information on the use of blood products (whole blood transfusion) and laparotomy in this category.

It should be noted that Caesarean Section is not an inclusion criteria for the WHO critical intervention criteria and are not included unless there are other complications present.

All relevant information about each case was recorded on a standard audit form devised by MCAI (see Appendix 4), which in addition to WHO-recommended items, included information on clinical management and birth outcomes.

Box 1. Inclusion criteria for baseline assessment of quality of care

Severe maternal complications
- Severe postpartum haemorrhage
- Severe pre-eclampsia
- Eclampsia
- Sepsis or severe systemic infection
- Ruptured uterus
- Severe complications of abortion

Critical interventions or intensive care unit use
- Admission to intensive care unit
- Interventional radiology
- Laparotomy (includes hysterectomy, excludes caesarean section)
- Use of blood products

Life-threatening conditions (near-miss criteria)
- Cardiovascular dysfunction
  - Shock, cardiac arrest (absence of pulse/heart beat and loss of consciousness), use of continuous vasoactive drugs, cardiopulmonary resuscitation, severe hypoperfusion (lactate >5 mmol/l or >45 mg/dl), severe acidosis (pH <7.1)
- Respiratory dysfunction
  - Acute cyanosis, gasping, severe tachypnea (respiratory rate >40 breaths per minute), severe bradypnea (respiratory rate <6 breaths per minute), intubation and ventilation not related to anaesthesia, severe hypoxemia (O2 saturation <90% for ≥60 minutes or PAO2/FiO2 <200)
- Renal dysfunction
  - Oliguria non-responsive to fluids or diuretics, dialysis for acute renal failure, severe acute azotemia (creatinine ≥300 µmol/ml or ≥3.5 mg/dl)
- Coagulation/haematological dysfunction
  - Failure to form clots, massive transfusion of blood or red cells (≥5 units), severe acute thrombocytopenia (<50 000 platelets/ml)
- Hepatic dysfunction
  - Jaundice in the presence of pre-eclampsia, severe acute hyperbilirubinemia (bilirubin >100 µmol/l or >6.0 mg/dl)
- Neurological dysfunction
  - Prolonged unconsciousness (lasting ≥12 hours)/coma (including metabolic coma), stroke, uncontrollable fits/status epilepticus, total paralysis
- Uterine dysfunction
  - Uterine haemorrhage or infection leading to hysterectomy

Maternal vital status
- Maternal death

This case identification was supplemented by review of the transfer-out cases and cases receiving care in the operating theatre for this period. In each identified case, a unique reference number was used, allowing for correlation with the full audit tool.

To assess the appropriateness and quality of the clinical management provided in each case, the management of all identified cases was reviewed in detail to check that in- facility treatment and management protocols had been applied and followed. These protocols, concordant with WHO evidence-based guidelines, have been provided by MCAI in its textbook and pocketbook.

The following specific protocols were undertaken:

1) For eclampsia and severe pre-eclampsia, magnesium sulphate, antihypertensive drugs, urgent delivery as appropriate and circulating fluid volume management.
2) For antepartum haemorrhage, shock management including lateral tilt and ideally fresh blood transfusion with urgent caesarean section if required.
3) For post partum haemorrhage, oxytocin prophylaxis, prevention and treatment, other uterotonic drugs (misoprostol or ergometrine), manual removal of placenta if needed, condom catheter uterine tamponade and repair of perineal trauma.
4) For ruptured ectopic pregnancy, shock management and laparotomy.
5) For ruptured uterus, repair when possible or emergency hysterectomy if needed.
6) For septicaemia, shock management, IV antibiotics, surgery when appropriate.

Results

Identification of women experiencing life-threatening emergencies

The number of identified cases in each WHO category are shown in Table 4. Some patients fell into more than one category.

Table 4: Summary monthly data for 4 categories WHO 1st April to July 31st 2015	
Morbidity Conditions in the audited sample of women with potential life threatening conditions and severe maternal outcomes (MANY PATIENTS HAD MORE THAN ONE POTENTIALLY LIFE THREATENING CONDITION ACROSS MORE THAN ONE CATEGORY, AND THUS THE TOTAL NUMBER OF CONDITIONS IS GREATER THAN THE NUMBER OF PATIENTS)	
Morbidity Conditions	No
Potentially life threatening conditions	162
1.Women with severe maternal complications NOTE: some had more than 1 life threatening condition	124
Severe postpartum haemorrhage	37
*Significant antepartum haemorrhage**	*30*
Severe Pre-Eclampsia	62
Eclampsia	15
Sepsis or severe systemic infection	11
Ruptured Uterus	1
Severe complications of abortion (including ruptured ectopic pregnancy)	8
Maternal deaths	3
2.Women undergoing critical interventions NOTE: some had more than 1 critical intervention	92
Use of blood products (whole blood transfusion)	90
Laparotomy	8
Interventional radiology	N/A
Admission to Intensive Care Unit	N/A
3. Women having life-threatening organ dysfunction (i.e. near miss criteria) NOTE: some had more than 1 organ dysfunction	37
Cardiovascular dysfunction	17
Respiratory dysfunction	0
Renal dysfunction	1
Coagulation/Haematologic Dysfunction	24
Hepatic dysfunction	0
Neurologic dysfunction	2
Uterine dysfunction/hysterectomy	1
Unspecified organ dysfunction	0
Multiple organ dysfunction (2 or more)	5
4. Organ dysfunction in maternal deaths during the 4 months ** NOTE: some had more than 1 organ dysfunction	3 (2 at EFSTH)
Cardiovascular dysfunction	
Respiratory dysfunction	
Renal dysfunction	
Coagulation/Haematologic Dysfunction	
Hepatic dysfunction	
Neurologic dysfunction	
Uterine dysfunction/hysterectomy	
Unspecified organ dysfunction	
Multiple organ dysfunction	3

* not part of the WHO category ** One of these 3 deaths followed an anaphylaxis to a blood transfusion given at EFSTH. This case did not fulfil entry criteria for WHO serious maternal complication or organ dysfunction when at BHMC

The retrospective case note review of maternity patients admitted to BMHC from April 1st 2015 to July 31st 2015 revealed that 124 patients admitted to the maternity unit were admitted with or developed a serious complication (as per the WHO/MCAI criteria). 162 women had a potentially life-threatening condition.

Table 4 summarises the results of potentially life threatening conditions. During these 4 months there were 1465 deliveries in BMHC. However, details of the number of pregnant women admitted during this time period were not available. Therefore, it is only possible to state that 124 (8.5%) women experienced severe complications out of 1465 mothers who delivered live or dead babies in this time period.

62 women experienced severe pre-eclampsia and 15 women developed eclampsia. 66 women experienced severe ante- or post-partum haemorrhage (some had both). 11 women had severe infection, 7 experienced complications of abortion (5 of whom had a definite ruptured ectopic pregnancy) and 1 women developed a ruptured uterus.

During this 4-month window, 3 maternal deaths occurred. A summary of each of these deaths is given within the previous mortality data (See Tables 1 and 2).

Assessment of clinical management

Table 5 summarises the various management and outcome indicators for the life threatening conditions identified.

For 37 women with severe PPH prior to discharge from BMHC, 4 records were missing but **all cases with records** received appropriate uterotonic drugs and other treatments such as removal of retained products, condom catheter or hysterectomy, as indicated. There were no deaths.

For 30 women with significant APH (26 secondary to abruption and 4 to placenta praevia) all cases were managed appropriately, excepting the fact that 6 could of these cases could have remained at BMHC if the operating theatre was operational.

For 62 women with severe pre-eclampsia all cases were appropriately managed. One died at EFSTH after transfer.

All 15 patients with eclampsia were managed appropriately with magnesium sulphate and antihypertensive drugs. None died.

Ten of 11 patients with severe sepsis were treated with intravenous antibiotics. The remaining patient may have been treated appropriately but the case notes were incomplete so this could not be determined. One severe sepsis patient died at BMHC having been admitted critically ill with a severe chest infection.

Three patients with heavy bleeding following an incomplete miscarriage were successfully treated by evacuation of retained products and in one of these cases uterotonics were also used. All 3 cases were appropriately managed.

For 6 patients with a ruptured ectopic pregnancy, all cases were treated appropriately. Because of a lack of an anaesthetist and operating theatre function, one case was referred to EFSTH.

Of 18 women with preterm births, clinical review established appropriate administration of antenatal corticosteroids in 12 cases (67%).

For 3 women with other severe complications (ruptured uterus in one case, appendicitis in early pregnancy in one case, and torsion of an ovarian cyst in early pregnancy in one case), all were managed appropriately and none died.

Table 5: Process and outcome indicators related to specific life threatening conditions : 1 April 2015 to 31 July 2015		
Indicators	**Number**	**Percentage**
Treatment of severe postpartum haemorrhage		
Target population: women with severe PPH	30 (NB. 7 Post Natal admissions following severe PPH omitted from this number and analysis as requiring blood but not uterotonics by time of admission*)	
Oxytocin use (for PPH treatment) NOTE: Although not documented in all 23 patients with primary PPH (i.e. before discharge from BMHC) all received both a bolus of oxytocin and also an infusion. Nearly all patients now receive this drug as a prophylactic measure	21	70%
Ergometrine	12	36%
Misoprostol Not of proven additional benefit if oxytocin was available and therefore only used if PPH continued despite oxytocin given.	10	30%
Any of the above uterotonics	26 (NB: 4 records missing outlining PPH management)	87%
Removal of retained products	6	20%
Balloon or condom tamponade	4	12%
Hysterectomy	1	3%
Maternal mortality	0	0
Clinical Review established appropriate management of severe PPH	26 (NB: 4 records missing outlining PPH management)	87%
	*Postnatal admissions requiring fluids and **blood only** also received appropriate clinical management	
Treatment of significant Antepartum Haemorrhage (APH)		
Target population : women having a significant antepartum haemorrhage	30	
Abruption or suspected abruption	26	86%
Placenta praevia or suspected placenta praevia	4	13%
Blood transfusion for APH	24	80%
Delivery at BMHC	19	63%
In-utero transfer to EFSTH	11 (included 4 IUFDs)	36%
In-utero transfer to EFSTH in view of prematurity	5	
Maternal mortality	0	
Associated IUFD prior to admission	15	50%
Live births at BMHC post significant APH	6	20%
Clinical review established appropriate APH management	30 (within the limits of resource availability i.e six cases could have stayed at BMHC for delivery if theatre/ anaesthetist availability)	100%
Treatment of severe pre-eclampsia		
Target population: women with severe preeclampsia	62	
Magnesium sulphate	61	98%
Hydralazine	38	61%
Nifedipine	57	92%
Other anti-hypertensive drug	1	1.6%

Table 5: Process and outcome indicators related to specific life threatening conditions : 1 April 2015 to 31 July 2015		
Any anti-hypertensive drug	57	92%
Mortality	1 (@EFSTH after transfer from BMHC)	1.6%
Note	5 hypo/normotensive	8%
Clinical Review established appropriate management of severe preeclampsia	62	100%
Treatment including anticonvulsants for eclampsia		
Target population: women with eclampsia	15	
Magnesium sulphate (MgSO4)	15	100%
Diazepam	1 (and also MgSO4)	6%
Hydralazine	10	67%
Nifedipine	13	87%
Any anti-hypertensive	13	87%
Mortality	0	0
Clinical Review established appropriate management of eclampsia	15	100%
Treatment for sepsis/severe systemic infection		
Target population: women with sepsis	11	
Parenteral therapeutic antibiotics	10 (? + 1 – records incomplete)	91 %
Exploratory Laparotomy	1	9%
Mortality	1	9%
Clinical Review of appropriate sepsis management	10 (1 set of records incomplete)	91%
Treatment for severe haemorrhage post incomplete abortion		
Target population: women with severe haemorrhage post incomplete abortion	3	
Evacuation of retained products	3	100%
Uterotonic used	1	33%
Blood transfusion	3	100%
Mortality	0	
Clinical Review established appropriate management of severe haemorrhage post incomplete abortion	3	100%
Treatment for ruptured ectopic pregnancy		
Target population : women with an ectopic or suspected ectopic pregnancy	6	
Un-ruptured ectopic (USS diagnosis)	1 : Laparotomy at BMHC	
Ruptured ectopic	4 : Laparotomy at BMHC	
? ectopic	1 : Transferred BMHC	
Laparotomy for ectopic at BMHC	5	
Mortality	0	
Clinical Review established appropriate management of ectopic or suspected ectopic pregnancy	6 (within the limits of resource availability i.e one required transfer as no theatre/ anaesthetist availability)	100%
Preterm Birth		
Target population : women having a preterm delivery or preterm in-utero transfer	18	
Corticosteroids for fetal lung maturation	11	61%
No record of corticosteroid administration	6	33%
Clinical Review established appropriate administration of corticosteroids (- not indicated in one case due to maternal pyrexia)	12	67%
Other Severe Complications	NB: all had appropriate clinical management	
Ruptured Uterus	1: Included in severe PPH analysis > hysterectomy	Previous CS, slow progress. Decision for CS : uterine rupture discovered at CS.
? Appendicitis	1	At 16 weeks gestation transferred to EFSTH

Table 5: Process and outcome indicators related to specific life threatening conditions : 1 April 2015 to 31 July 2015		
Ovarian torsion & cyst	1	Laparotomy at BMHC (? early pregnancy)

Discussion

Although inappropriate to extrapolate the findings from a 4 month period to the whole of 2015, the findings suggest that over 500 women in the Brikama area could experience severe maternal complications and life-threatening conditions in a single year. This excludes patients requiring a caesarean section without meeting one of the above criteria, e.g. Caesarean section for obstructed labour or fetal distress.

The high number of women experiencing severe maternal complications and life-threatening conditions highlights the priority to ensure that comprehensive Emergency Obstetric Care is continuously provided at BMHC. All the serious complications that occurred could have resulted in death without appropriate clinical management. As analysed above, and taking into account missing case records, the vast majority of cases reviewed had appropriate clinical management and received large elements of their care by the obstetric trainees with the supervision and support of the MCAI trainers.

The lack of clinical records in some cases is disappointing and since this case review, great efforts have been made to improve recording clinical information in all patients notes and their storage.

Objective 3: To measure improved function of the maternity unit at BMHC in providing comprehensive emergency obstetric care

Methods

Three functions were selected to represent the provision of comprehensive emergency obstetric care:
1) The use of the maternity operating theatre at BMHC and the undertaking of an appropriate operation (including Caesarean Section)
2) The number of maternity transfers from BMHC to EFSTH
3) The use of whole blood transfusion

The rationale for selecting maternity operating theatre use was to show the range of surgeries performed and to record the number of Caesarian Sections, a WHO CEmOC signal function. These data were routinely recorded throughout 2014/15

The number of maternity transfers from BMHC to EFSTH was selected to show the capability of BMHC to provide comprehensive emergency obstetric care for complicated cases without the need to transfer seriously ill patients.

The use of whole blood transfusion was selected because it is a signal function of CEmOC. As the use of blood transfusion was not routinely recorded, the use of blood transfusion in the 4 month period selected for the Near Miss study (April 1st 2015 to July 31st 2015) was reviewed.

Results

Maternity operating theatre use and type of surgery undertaken

Table 6 shows the number and type of maternal surgery undertaken in 2014 and in 2015.

During 2014, the operating theatre was only in use for 6 months over two time periods: January 2014 to April 2014 and October 2014 to mid December 2014. There was a total of 73 advanced obstetric operations during these periods including 57 Caesarean sections. International MCAI obstetricians were present in BMHC from August to December 2014.

In 2015 the operating theatre was was unable to provided 24/7 service because of a lack of anaesthetic cover and other staffing problems. The theatre was closed for 10 weeks whilst repairs to the maternity unit roof were completed. There was a total of 275 advanced obstetric operations throughout the year, including 148 Caesarean sections.

Table 6: Details of maternal surgery undertaken at BMHC		
Type of operation	**Number in 2014**	**Number in 2015**
C Section and bilateral tubal ligation	07	21
C Section	50	127
Obstetric hysterectomy	02	02
Bilateral tubal ligation alone	02	41
Ovarian cystectomy	01	02
Oophorectomy	01	
Removal ruptured ectopic pregnancy	03	10
Evacuation retained products of conception	06	40
Repair of cervical tear	01	16
Repair of third degree tear		04
Repair of perforated uterus		02
Laparotomy		04
Vacuum delivery		01
IUCD Removal		01
Incision and drainage of breast abscess		01
Examination under anaesthetic		02
Incision and drainage of Bartholin's abscess		01
TOTAL	73	275

Number of Transfers

The number of maternal transfers from BMHC to EFSTH in 2014 and 2015 has already been shown in Table 3 but is copied again here. There was a 38% reduction in maternal transfers between the two years.

Table 3: Maternity Transfers from BMHC to EFSTH January 1st 2014 to December 31st 2014 & from January 1st 2015 to December 31st 2015			
Month	**Year**	**No. referrals of pregnant patients to EFSTH from Brikama**	**No: deliveries at Brikama MHC**
January	**2014**	**45**	**537**
February	**2014**	**28**	**474**
March	**2014**	**33**	**491**
April	**2014**	**34**	**464**
May	**2014**	**32**	**347**
June	**2014**	**35**	**311**
July	**2014**	**34**	**299**
August	**2014**	**38**	**344**
September	**2014**	**52**	**486**

Table 3: Maternity Transfers from BMHC to EFSTH January 1st 2014 to December 31st 2014 & from January 1st 2015 to December 31st 2015			
October	**2014**	**42**	**568**
November	**2014**	**52**	**501**
December	**2014**	**31**	**489**
TOTAL	**2014**	**456**	**5311**
January	**2015**	**17**	**503**
February	**2015**	**17**	**454**
March	**2015**	**19**	**456**
April	**2015**	**17**	**444**
May	**2015**	**38**	**387**
June	**2015**	**36**	**316**
July	**2015**	**20**	**318**
August	**2015**	**12**	**348**
September	**2015**	**38**	**425**
October	**2015**	**39**	**499**
November	**2015**	**16**	**501**
December	**2015**	**15**	**532**
TOTAL	**2015**	**284**	**5183**
January	**2016**	**17**	
February	**2016**	**14**	
March	**2016**	**10**	
In conclusion, there were 456 referrals to EFSTH in 2014 and 284 in 2015 which is a reduction of 172 cases (38% reduction)			

Use of whole blood transfusion for the near miss patients

As shown previously in Table 4 (objective 2 section), 90 women experiencing life threatening conditions during the 4 month period from 1st April to 31 July 2015 received whole blood transfusions. During these 4 months, there were 1465 deliveries in BMHC, but details of the number of pregnant women admitted during this time period were not available. Thus, all that can be stated is that during this 4 month period, 90 women out of 1465 (6.1 %) who delivered live or dead babies received a blood transfusion.

Discussion

The results shows that the functionality and ability to provide a full comprehensive emergency obstetric care service improved in the intervention period. Of note, an increase in the availability of the operating theatre correlates with a reduction in transfers to EFSTH.

Despite the problems with staff cover and other issues affecting the utilisation of the maternity operating theatre in 2015, for example the closure for a new roof to the maternity unit and lack of senior doctors to cover on call duties, the use of the operating theatre increased from 73 cases in 2014 to 275 in 2015. This positive development demonstrates the effectiveness of the intervention, which has led to the capability of BMHC to safely manage many cases that would previously have needed transfer out to EFSTH. The large reduction in transfers from BMHC to EFSTH between 2014 and 2015 further validate the effectiveness of the intervention.

6.1% of women delivering a baby (dead or alive) during the 4 month period April to July 2015 received a blood transfusion. In the UK, in one year approximately 4000 blood transfusions occur for 750,000 births (0.5%). [Green Top guideline 47 RCOG May 2015] The much higher proportion in

BMHC almost certainly relates both to the high prevalence of placental abruption and the prevalence of symptomatic severe anaemia in pregnancy, which is particularly dangerous when pregnancy is ending and delivery imminent or when there is a complication such as an incomplete miscarriage or ruptured ectopic pregnancy. In addition, 7 patients out of 37 with severe PPH needing a blood transfusion were admitted from the community highlighting issues of management there. Also, the high rate of endstage PET/eclampsia leading to coagulopathy, requires the use of blood to provide clotting factors, as well as red cells.

Objective 4: To assess the educational attainments of the obstetric trainees

Methods

The results of examinations for each trainee, were recorded along with a review of the procedures performed and recorded in the logbooks of each trainee. The range and type of formative assessments were also recorded.

Results

Table 7 presents the results for each trainee on the post-foundation training course examination.

Table 7: Results of post-foundation training course examination

Candidate Name	Exam Component			Total Mark
	OSCE* stations	Anatomy 'spot exam'**	SAQ***	
Dr A Kanteh	85%	77%	96%	**85%**
Mr A Faye	82%	87%	83%	**84%**
Mrs F Camara	76%	84%	53%	**73%**
Dr A Bojang	84%	100%	67%	**84%**
Dr M Sanyang	72%	84%	75%	**76%**
Dr Yorro Bah	91%	100%	94%	**94%**

Red – Denotes 2014/2015 cohort

* OSCE – Objective Structured Clinical Examination

** 'Spot Exam' – Identification of anatomical landmarks on photographs and diagrams

*** SAQ – Short Answer Questions on mechanisms of labour

Table 8 presents the procedures performed and recorded by senior trainee midwives in their log-books (until 16th March 2016) and Table 9 presents the same information for junior doctor trainees (until 16th March 2016). The data collection is on-going.

Table 8: Procedures performed and recorded by senior trainee midwives in their log-books		
Procedure	**Number Performed**	
	Mr. A Faye (Jan/15-Dec/16)	**Mrs. F Camara (Nov/15 – Training ongoing)**
Vacuum delivery - OA	40	6
Vacuum delivery – OP/OT	10	
Twins delivery	20	4
Breech delivery	29	7
Eclampsia management	*Large numbers but not recorded*	3
Management of Cord prolapse	5	1
Management of Shoulder dystocia	8	
Episiotomy	37	9
Second degree tear repair	15	
Third degree tear repair	6	
De-fibulation (anterior episiotomy)	5	
4th Degree tear repair - assisted	1	
Cervical tear repair	3	
Post-natal vulval haematoma evacuation/repair	1	
Post-coital vaginal wall tear repair	2	
Condom Tamponade	10	2
Bimanual compression and PPH management	19	4
Manual removal of placenta	7	
Neonatal resuscitation	40	4
External Cephalic Version	5	2
Drainage of hydrocephalus per vagina	2	
Uterine Evacuation - MVA	25	6
Uterine evacuation - Sharp curettage	27	1
I+D Vulval abscess	1	
I+D Breast abscess	2	

Dr. Kanteh and Mr Faye, the first two trainees on the programme

Table 9 procedures performed and recorded by doctor trainees in their log-books				
Procedure Performed	**Number Performed**			
	Completed Training	**Current trainees – Nov/15 - ongoing**		
	Dr. Kanteh	**Dr. Bojang**	**Dr. Bah**	**Dr. Sanyang**
C/S - assisted	4	3	10	6
C/S – direct supervision	55	17	16	4
C/S – indirect supervision	12			
C/S – complex case	29			
Hysterectomy - assisted	1	1		
Hysterectomy - supervised	2			
Vacuum delivery	18 - *incomplete data*	2	2	2
Bilateral Tubal Ligation	29 - *incomplete data*		8	
Ectopic - assisted	4	2		
Ectopic – direct supervision	7	2		
Ectopic – indirect supervision	3			
Breech Delivery	15	8		4
Twins delivery		4	6	2
Management of Cord prolapse				
Management of Shoulder Dystocia	4			
Condom balloon catheter	7 *incomplete data*		3	
Perineal tear repair			15	4 - Data incomplete
3rd degree tear repair	15	1		
Cervical tear repair	2	1		
Manual removal of placenta	5	1		
Oophorectomy (ovarian cyst)	3			
Marsupilisation Bartholin's abscess	1			
Eclampsia management	*Data not collected*		8	1 - Data incomplete
Evacuation – MVA and Curretage		9	22	*2 - Data incomplete*
Dilation and Currettage/MVA		3	1	

A full account of formative assessments for all 6 obstetric trainees is given in Appendix 3. These cases do not represent all cases managed by the trainee but a small sample of managed cases which were formally discussed with the clinical supervisor in a formative assessment. For illustration purposes, the formative assessments undertaken with Mr. Arfang Faye (senior midwife) are presented below (see Table 10).

Table 10: Formative assessment forms undertaken with Mr. Arfang Faye (senior midwife)		
Assessment Form Type	**Number Completed**	**Topics covered**
Case Based Discussion	26	Delay 1st stage and use oxytocin
		Abruption + IUFD x 3
		Premature rupture of membranes
		Obstructed labour
		Placenta praevia
		Pyelonephritis
		Pyrexia of unknown origin
		Severe pre-eclampsia x 2
		Genital tract trauma
		Eclampsia
		Severe anaemia/shock post-partum x 2
		Twin Pregnancy
		Epilepsy in pregnancy
		Resus iso-immunisation
		APH – unclear cause
Supervisor Observed Experience	26	2nd trimester IUFD
		Failure to progress x 2
		Previous caesarean section x 2
		Moderate Pre-eclampsia at term x 2
		Severe Pre-eclampsia x 4
		Severe hyper-emesis
		3rd trimester IUFD unknown cause
		Puerperal sepsis secondary to endometritis
		Massive placental abruption +IUFD x 3
		Pneumonia
		Fetal Distress
		Post-partum Eclampsia
		PROM and PIH
		Bladder over-distention in labour
		Severe Pre-eclampsia and SOB
Reflective Practice	4	Missed retained placenta in mid-trimester abortion
		Missed Placental abruption
		Delay in management of PPH
		Sub-optimal management of team

Discussion

These results highlight the high educational achievements attained by each trainee and also clearly show wide range of obstetric procedures that each is able to perform. This information supports the ability of each trainee, with appropriate support and supervision, to provide CEmOC, as a result of the Advanced Obstetric Training component of the intervention.

To further support the ability of each trainee, as shown in Objective 2, the vast majority of women experiencing life-threatening complications had appropriate clinical management and received large elements of their care by the obstetric trainees with the supervision and support of the MCAI trainers.

The high-intensity and comprehensive nature of the Advanced Obstetric Training Programme, combined with high quality, hands-on training and supervision, are important factors in ensuring the success of the Advanced Obstetric Training Programme component of the Brikama Obstetric Project.

Objective 5: To assess the situation regarding intra-uterine fetal deaths at BMHC

MCAI has widely observed the poor outcomes for neonates at BMHC. Unfortunately, to date, routinely collected data on neonatal outcomes has not been recorded. In the absence of this important data, using a pragmatic approach, MCAI decided to review available data on intra-uterine fetal deaths (IUFDs) as an initial audit assessment, which could also potentially provide some insights into the situation for neonates.

Methods

Routinely collected data on birth outcomes for maternity patients admitted to BMHC in 2014 and 2015 were recorded and categorised into IUFDs and live births. The rate of IUFDs (per 1000 deliveries) was calculated for each year.

To add further insight, the birth outcomes of women experiencing serious complications who were identified in the 4-month maternal near miss period (April 1st 2015 to July 31st 2015) were recorded and categorised into live births and IUFDs.

There were no neonatal outcomes recorded during this period. However, a system to make monthly returns on maternal and neonatal data is now established and should capture neonatal deaths in the future.

Results

Table 11 shows the number of live births and IUFDs for each month of 2014 and 2015.

Table 11: The number of live births and IUFDs for each month of 2014 and 2015

Month	Year	Number of deliveries	Number of live births	Number of intrauterine fetal deaths
January	**2014**	**537**	521	16
February	**2014**	**474**	457	17
March	**2014**	**491**	474	17
April	**2014**	**464**	440	24
May	**2014**	**347**	334	13
June	**2014**	**311**	298	13
July	**2014**	**299**	296	3
August	**2014**	**344**	324	20
September	**2014**	**486**	472	14
October	**2014**	**568**	553	15
November	**2014**	**501**	486	15
December	**2014**	**489**	477	12
TOTAL	**2014**	**5311**	**5132**	**179 (3.4%)**
January	**2015**	**503**	481	22
February	**2015**	**454**	436	18
March	**2015**	**456**	442	14
April	**2015**	**444**	428	16

Table 11: The number of live births and IUFDs for each month of 2014 and 2015				
Month	Year	Number of deliveries	Number of live births	Number of intrauterine fetal deaths
May	**2015**	**387**	369	18
June	**2015**	**316**	312	4
July	**2015**	**318**	300	18
August	**2015**	**348**	329	19
September	**2015**	**425**	408	17
October	**2015**	**499**	477	22
November	**2015**	**501**	468	33
December	**2015**	**532**	506	26
TOTAL	**2015**	**5183**	**4956**	**227 (4.4%)**

These figures show that the total IUFD rate in 2014 was 34/1000 deliveries and 44/1000 deliveries in 2015.

From the Life Threatening Conditions case study
Table 12 list the number of live births and IUFDs recorded for the 4 month period in 2015. The number of transfers is listed for information but not included in the denominator. Also of note, data on live births may not account for the possibility of multiple births in some cases.

Table 8 Data on live births, intrauterine fetal deaths and stillbirths from life threatening near-miss maternal data					
Month	Babies born alive	IUFDs	Stillbirths	Totals	*Intrauterine transfers and baby outcome unknown*
April 2015	23	12	1	36	*11*
May 2015	18	9	1	28	*9*
June 2015	15	1	0	16	*8*
July 2015	12	9	1	22	*4*
Totals	**68 (67%)**	**31 (30%)**	**3 (3%)**	**102**	*32*

It is important to highlight that the small number of fetal deaths which were stillbirths (10% of 34 = 3) represented the only intrapartum deaths. All the other coded as IUFDs were identified as fetal deaths on admission to BMHC and therefore pre-delivery and not responsive to clinical intervention.

Discussion

These results highlight the high number of IUFDs at BMHC. The high rates (34/1000 deliveries in 2014 and 44/1000 deliveries in 2015) is higher than the 26/1000 deliveries recorded for The Gambia in 2011 [State of the World's Midwifery 2011 Delivering health and saving lives]. As a comparison, the stillbirth/IUFD rate in Afghanistan, Somalia, and South Africa in 2011 was 29/1000, 30/1000, and 21/1000 respectively.

These high numbers are further supported by the results of the 4-month case study, which shows that a third of high risk deliveries at BMHC resulted in a fetal death.

We cannot explain why the numbers of IUFDs increased in 2015. The most likely reason is that more high risk patients were being retained for treatment at BMHC and that these were more likely to have IUFD's. Moreover, during the 4 month audited period for life threatening maternal conditions the vast majority of women had IUFD's on arrival rather than an intrapartum fetal death.

Since nearly all IUFDs happen before arrival at BMHC, the situation can only really be improved by improved antenatal care, which to date, has not been a strong component of the Brikama Obstetric Project. The new triage unit is partly addressing this issue, but the most effective way of reducing IUFDs relates to the detection and management of pre-eclampsia with the introduction of a dedicated blood pressure and urine protein monitoring clinic coupled with accurate ultrasonographic dating of the pregnancy to aid decisions regarding timing of delivery. MCAI is currently liaising with the in-facility midwifery ante-natal clinic to improve care pathways for high risk patients, and would like to eventually extend these pathways to the surrounding minor health facilities. Unfortunately, inadequate staffing is hindering attempts to develop this service.

Furthermore, in combination with the paucity of neonatal outcome data, these results demonstrate the lack of attention given to neonatal care to date. Many babies are dying unnecessarily at BMHC because of the lack of a proper neonatal service and a large number of babies and mothers are referred to EFSTH because of this lack of neonatal care. Moving forward, any future plans should involve a comprehensive intervention [with health system strengthening (including building a neonatal unit) service delivery, and apprenticeship training], similar to that for obstetrics. MCAI is currently devising plans for such a programme with estimated costs.

Conclusion

Summary of the main results

Accurate analysis of maternal mortality for 2013-2014 was not possible because of the lack of, or limited data, available. It is therefore difficult to establish the impact of the intervention in this regards n 2015. This interim analysis found that there were 6 maternal deaths at BMHC in the limited periods in 2014 where data was available and 8 maternal deaths for the whole of 2015. In 2014, there were 9 maternal deaths following transfer from BMHC to EFSTH and 6 such deaths in 2015.

The natural variation in maternal mortality rates, poor antenatal care, and the delays in presentation of patients who are critically ill and therefore almost impossible to resuscitate, all contribute to making an accurate evaluation difficult. However, the introduction of systems to better record data and attempts to encourage the local population that given the major improvements in BMHC, they should attend earlier if suffering a complication of pregnancy or delivery, might soon begin to provide evidence of an improved MMR as a result of the intervention. Healthworkers in the primary healthcare sector of the Brikama region (including Traditional Birth Attendants) must also be more proactive in referring patients with potentially life threatening problems into the health centre. The re-introduction of the emergency ambulance transport system ('flying squad') established by MCAI 10 years ago may help.

In a 4 month period in 2015, 124 patients admitted to the maternity unit were admitted with or developed a serious complication and 162 women had a potentially life-threatening condition. Analysis of the life-threatening complications reveals high quality evidence of the effectiveness of the intervention. Almost every serious complication of pregnancy or delivery was managed according to evidence-based guidelines and protocols established as part of the intervention. The trainees provided much of the clinical management, which provides further evidence of the effectiveness of the educational component of the project, further demonstrated by the high educational achievements attained by each trainee and the range of obstetric procedures that they have been trained to perform, as demonstrated in their exam outcomes and each of their logbooks. Much of this care was, however, only achieved because of the availability of essential drugs such as oxytocin and essential surgical supplies such as sutures provided by MCAI. Such essential components of comprehensive emergency obstetric care should have been the responsibility of the MoHSW.

During the intervention period, there has been an improvement to the functionality and ability of BMHC to provide CEmOC. There has been a major increase in the number of advanced obstetric operations and a 38% reduction in transfers to EFSTH. A high proportion of patients (6%) received life saving blood transfusions reflecting the high levels of severe anaemia, ante-partum and post-partum haemorrhage in the patients attending BMHC.

The IUFD rate at BMHC in 2014 was 34/1000 deliveries and 44/1000 deliveries in 2015. Furthermore, in the 4 month case study, a fetal death was present in a third of high risk deliveries at BMHC. The continuing and very high rate of IUFDs on arrival at BMHC needs to be addressed by major improvements to antenatal care in the Brikama region. MCAI already has plans to address this issue but these plans may be hindered by a lack of midwives to run the planned intervention.

The registration of neonatal deaths has just started but already shows the urgent need for high quality, basic neonatal care to be undertaken in a newly built special care neonatal unit based adjacent to the maternity unit.

Implications of the Results

Although it is difficult to reach any conclusions regarding the impact of the Brikama Obstetric Project on maternal mortality because of the limitations to the data, this interim analysis provides robust evidence to show that the high numbers of women experiencing maternal complications and life-threatening conditions received appropriate, high quality clinical management. Combined with the evidence showing the improved ability of BMHC to provide comprehensive emergency obstetric care, and evidence of the high quality, wide-ranging training each trainee receives to attain high educational outcomes, this interim analysis shows the value of the project and the supportive evidence necessary to make a strong case for the continuation of the Brikama Obstetric Project with an appropriate level of funding.

Costs

The expenditure of the Brikama Obstetric Programme from 1 Nov 2014-31 December 2015, was £64,596 and a detailed breakdown is shown in Appendix 6. This figure excludes the first 3 months of the introductory phase of the intervention, a period in which many health system strengthening improvements were implemented. Including the expenditure of the first 3 months and given expenditure rates to date, by the end of the second year of the project (31 October 2016), MCAI and ALSG will have spent over £120,000 on running the first two years of the Brikama Obstetric Project. Although a cost-effectiveness analysis is beyond the scope of this interim analysis, the positive results indicate value for money.

Future plans

For the past 4 years, MCAI and ALSG have been advocating that the MOHSW and Gambian Medical and Dental Council (GMDC) undertake task shifting to enable senior midwives to be trained in advanced obstetrics including abdominal obstetric surgery. Unfortunately, despite the fact that there are very few Gambian-trained doctors working in rural hospital facilities, and the success of MCAI's similar project in Liberia [see: http://www.who.int/bulletin/volumes/94/5/en/ for description of the WHO Bulletin theme issue containing the paper and http://www.who.int/bulletin/volumes/94/5/15-160473.pdf?ua=1 for the paper itself], this approach has not been agreed by the MOHSW and GMDC.

MCAI and ALSG continue to believe that not only is task shifting the way forward for The Gambia but is also more likely to attract funding urgently needed for the obstetric and proposed neonatal projects.

Given the clear need and demonstrated value of the Brikama Obstetric Project, MCAI and ALSG hope that the project (with its improved health system strengthening with health service delivery and advanced obstetric training components) can continue with appropriate funding. As previously stated, funding for the programme will run out by October 2016 so, at this time, the project will have no option but to end if no further funding can be secured. MCAI is currently devising a plan and budget for the necessary funding required for the continuation of the Brikama Obstetric Project.

The paucity of neonatal data in this study, demonstrates the lack of attention given to neonatal care to date. Many babies are dying unnecessarily at BMHC because of the lack of a proper neonatal service and a large number of babies and mothers are referred to EFSTH because of this lack of neonatal care. Neonatal sepsis remains a major problem and the Brikama team struggle with appalling levels of hygeine and poor awareness of infection control measures. Currently, efforts are being made to address this issue by providing cleaning maternials and infection-control

training to all midwives, however, there is a need for additional cleaning staff and sustainable material support to ensure a lasting change.

Moving forward, any future plans should involve a comprehensive intervention (health system strengthening (including building a neonatal unit) with service delivery and continued apprenticeship based training] similar to that for obstetrics. MCAI is currently devising plans for such a programme with estimated costs.

Acknowledgments

MCAI would like to acknowledge the commitment and dedication of all those who have supported the project since it began in August 2014.

We acknowledge the support of the MoHSW in particular The Honourable Minister, Dr Omar Sey, The Director of Health Services, Dr Samba Ceesay and Mrs Gomez, Chief Nursing Officer who have advocated for this project and provided the increased staffing to allow operating theatre and ward to function effectively. Dr Ceesay also helped identify doctors suitable for training. We also thank Bafoday Jawara on behalf of the RCH unit for the help given to improving service delivery at BMHC.

The WHO and UNFPA teams have been supportive. In particular they were instrumental in arranging the roof repair and advocating for us at a national level.

We are especially grateful for funding from Soroptimists International of Great Britain & Ireland (SIGBI), The Advanced Life Support Group (especially Dr Barbara Phillips and Mrs Sue Wieteska) and a major donor through the Strengthening Emergency Care project. We are also grateful for the many generous donations to MCAI's Brikama Fund which has made it possible to complete the second year of trainng.

Mr. Saaro Darboe has provided in-country logistic support, including safe transport, financial management and safety and security back-up.

Our first group of trainees, Dr Abdul-Hamid Kanteh and Mr Arfang Faye were crucial in the success of the project to date. Their ability to learn quickly coupled with their tireless commitement to the women of Brikama have enabled the service to be maintained in very difficult circumstances. We have been grateful for their input into training their junior colleagues and are sure they will be valuable assets to The Gambia in the future.

Our second group of trainees, Mrs Fatou Camara, Dr Mohammed Sanyang, Dr Abdou Bojang and Dr Yorro Bah have also been committed to their role and are progressing quickly through the Advanced Obstetric Curriculum.

The maternity unit staff who have welcomed us and been willing to change clinical practice significantly. They maintain a busy unit with care and good humour despite many challenges. Mr Omar Gassama, head midwife at BMHC, has implemented many of the MCAI systems for stock control and Mr Ebou Corr, officer in charge BMHC, has supported us as we made changes which affected the whole facility.

MCAI have welcomed several volunteers to Brikama throughout the project. MCAI medical volunteers, Dr Andrew Wood, Dr Diane Watson, Dr Catherine Cromey and Dr Padmani De-Silva provided valuable support to the anaesthetic team as the theatre was reopened and worked to improve the neonatal care provided. Dr Cheryl Anderson redesigned the sterilisation area and emergency boxes with visual standards to allow easy maintenance. She also assessed and arranged the technical details for the repair of the maternity unit roof and began implementation of the labour ward gantries for the provision of intravenous fluids and blood transfusions. Mr Thomas Sheridan provided training to MCAI's Logistician in electrical safety and building maintenance as well as providing tools necessary to complete work to a high standard. Mrs Judith Sheridan provided high quality aprons for the labour ward and curtains to the antenatal ward to allow patients privacy during examinations.

Dr Johan Creemers volunteered as an MCAI obstetric trainer for long periods in 2014 and 2015. We are grateful for his skill and dedication, his clinical and ultrasound training and calm approach in difficult times.

We would also like to acknowledge the work of the MCAI office staff in Scotland (Alison Grove, Janette Latta and Mairi Stephen) who have supported the volunteers in many ways and enabled us to remain safely in country. We also appreciate the input of Dr Alison Earley, a former MCAI Trustee.

Liverpool Women's Hospital, NHS Foundation Trust, UK have actively supported Dr Sheridan and Dr Clack by providing employment in the UK with long periods of leave so the training in BMHC could continue beyond August 2015.

Finally we acknowledge the women of Brikama and surrounding districts who have chosen to come to BMCH for maternity care during pregnancy and delivery. We hope that the service improvements can be maintained and built upon both locally and nationally.

Appendix 1: List of challenges at the start of the Brikama Obstetric Project

Clinical Care

- No system for proactively managing patients such as
    - Inadequate and incorrect use of the WHO partograph for those in labour
    - Patients in early labour designated 'walking around and not reviewed until requested by patient often several days later
    - No regular drug or observation rounds for in patients
    - No system for escalating care to obstetrician, in particular no regular medical rounds for inpatients or criteria for escalation short of obvious life-threatening emergency.
- Inadequate hand-over between shifts
- Complete absence of patient care pathways
    - No written guidelines or protocols
    - Dysfunctional triage system
    - Erratic in patient management/referral. For example, patients were frequently treated with a single dose of Magnesium Sulphate for severe pre-eclampsia then left on the ward without further maintenance doses and without a management plan so eclamptic convulsions occurring after magnesium administration were common.
- Gross under-staffing
    - Single Cuban gynaecologist working 24/7 resulting in night cover for life-threatening emergencies only.
    - Two midwives and one assistant on each shift focused on labour ward due to volume of work.
    - No designated ward staff; long periods when no clinical ward care offered.
- Operating theatre not functional: dirty, no safe sterilization protocol, inadequate theatre staff, instruments for caesarian section not available, essential consumables not available.
- All critical and high-risk patients referred by ambulance to Edward Frances Small Teaching Hospital often without stabilization and/or after very significant and life-threatening delays.
- No neonatal unit or ability to provide basic neonatal care

Stock Systems and Availability

- Non provision or frequent stock interruption of essential life-saving drugs and materials for labour ward including, oxytocin, misoprostol, hydralazine, nifedipine, all commonly used antibiotics, adrenaline, frusemide, diazepam, lignocaine.

- Non provision or frequent stock interruption of essential life-saving drugs and materials for the operating theatre including anaesthetic drugs, sutures, surgical haemostatic gauze; urinary catheters.
- Inadequate system for stock-checking and replenishment at local and regional level so a regular and continuous supply of items was not available to the unit

Environment and Organisation

- Extremely disorganized and dirty environment:
    - Cockroach infestation and frog and cats on the ward
    - Inadequate malaria protection: no bed nets and holes in window netting
    - No glass in windows and no way to ensure privacy for patients from those outside
    - No curtains around ward beds
    - No bed numbers
    - No paper-work: staff used scraps of paper or partograph, documenting in margin if not in labour
- Unsafe and disorganised sterilization and disinfection regimes.
    - Dry heat sterilization being used in a haphazard, incorrect and disorganized manner on the labour ward.
    - No system for high-level disinfection, no bleach available
- Maintenance problems that frequently left the unit without working sinks, toilets and electric power.
- Unsafe electrical equipment with no equipment or funds to make safe.
- Inadequate storage facilities for medicines and consumables.
- A seriously damaged maternity ward roof that allowed torrential leaking during the rainy season
- No “on-call” accommodation suitable for obstetric trainers or trainees
- No functional washing machines in laundry so blood stained drapes washed by hand.

Appendix 2: List of health system strengthening interventions and improvements made by MCAI in partnership with the MoHSW

Clinical Care

- **Clinical staffing**
    - Successful advocacy for nursing cover for the maternity wards
    - Currently 9 doctors/senior midwives staffing the maternity unit on a 1 in 3 or 1 in 4 three tiered rota; ensuring continuous emergency care provision
    - On-call financial incentives provided by MCAI to senior midwife graduates and trainers
    - Successful lobbying for adequate anaesthetic and scrub-nurse staff to provide a 24/7 operating service
    - On-call financial incentives provided by MCAI to theatre orderlies to enable 24/7 theatre coverage

- **Clinical Organisational Improvements**
    - Implementation of a daily multi-disciplinary hand-over
    - Implementation of a system for tracking and monitoring women in early and active labour
    - Introduction of a daily medical ward-round and continuous two/three tier cover for emergency care.
    - Introduction of a joint medical and midwifery triage from 9am to 4pm (staffing dependent)
    - Introduction of a daily doctor-run antenatal and ultrasound clinic providing an obstetric scanning service and medical care for high risk pregnancies
    - Implementation of four-times daily observation rounds and 6 times daily medication rounds by dedicated nursing/midwifery staff
    - Introduction of six clinical guidelines, with more planned
    - Introduction of closed user group on-call mobile phones for the midwifery team, the anaesthetist, and the 1st, 2nd and 3rd on-call doctors
    - Introduction of emergency boxes for management of eclampsia and post-partum haemorrhage with visual standards and audit to ensure maintenance.
    - Theatre nurse led dressing clinic for review of all patients post laparotomy/caesarean section patients with access to obstetric review if required

- **Operating Theatre**
    - Functional 24/7 significantly reducing referrals to EFSTH
    - Post-operative recovery managed on ward with specific protocol
    - Systems implemented and reviewed by UK based anaesthetists.
    - Range of procedures available increased significantly
    - Surgical equipment organized supplemented and a stock-system introduced

Stock Systems and Availability

- **Stock-control system improvements**
    - Introduction of weekly stock-checking in the labour ward and operating theatre
    - Introduction of a consumption record for the theatre and high value/controlled labour ward drugs and materials to ensure usage accounted for on a named patient basis.
    - Introduction of systems for ensuring adequate supplies of all consumables on a daily basis to minimize the risk of stock-outs on the maternity unit and operating theatre
    - Introduction of daily system to check availability of non-consumable clinical equipment on the maternity unit and the operating theatre
    - System for ordering safe and reliable medicines from the private market with MCAI funds when unavailable from the MoHSW

Drugs and materials provided or supplemented

- Continuously provided through MCAI as no supply from MoHSW
    - Sutures for the operating theatre and labour ward
    - Tramadol (intramuscular) and diclofenac (rectal)
    - Misoprostol
    - Ceftriaxone
    - Surgical gauze
    - Foley catheters
    - Adrenaline
    - Diazepam
    - Povidone iodine and chlorhexidine surgical preparation
    - Bleach
    - Urinalysis sticks
    - Surgical gloves of sizes <7.5

- Supplemented. i.e. intermittent supply from MoHSW
    - Metronidazole
    - Hydralazine
    - Lignocaine
    - Dexamethasone
    - Oxytocin
    - Spinal anaesthetic needles
    - Marcaine/Lignocaine for spinal injection
    - Ephedrine
    - Suxamethonium
    - Large bore intra-venous cannulae – larger than 20 Gauge

Environment and Organisation

- **Basic organisational measures to include:**
    - Provision of white boards to coordinate management of the labour ward, those in early labour and women at high risk requiring increased monitoring and medication.
    - Paperwork: customized forms including structured initial assessment, continuation sheets, lab-request forms, observation charts, prescription charts, blood transfusion forms, operation notes and follow-up slips. All printed on an MCAI-provided printer with MCAI-provided ink
    - Provision of clip-boards for each bed so paperwork remains with the patient

- **Basic Improvements to the environment:**
    - Provision of curtains to separate ward beds and provide privacy
    - Deep- cleaning to rid the wards of cock-roaches and an effort to improve the regular cleaning regime in the department
    - Provision and organisation of additional furniture for storage of material in the operating theatre and labour ward
    - Re-organisation of space available to provide a staff changing room and storage space
    - Installation of a gantry above all labour ward beds to enable the hanging of multiple intravenous fluids and blood, to compensate for an inadequate number of drip stands.
    - Provision of high quality re-usable aprons for use of by staff during procedures and deliveries
    - 'Lean' organisation of stock and equipment to ensure a clear system of storage

- **Providing access to an adequate number of and adequately sterilized delivery materials:**
    - 'Lean' organisation of labour ward sterilization area with clear processes for dry-heat sterilization and high level disinfection.
    - Visual standards displayed and training delivered for all staff in the process of dry-heat sterilization on the labour ward and for the operating theatre
    - Organisation and training in deep disinfection process on the labour ward
    - Provision of additional delivery Spencer Wells forceps, episiotomy and suturing equipment to ensure adequate supplies for the numbers of deliveries in the unit

- **Maintenance support**
    - Re-wiring and replacement of unsafe electrical sockets
    - All unit plugs changed to be compatible with the wall sockets available
    - Re-wiring of ward lights
    - Frequent repair of malfunctioning plumbing on the labour ward and in the operating theatre
    - Frequent repair of electrical faults in the maternity unit and the operating theatre
    - Advocating for emptying of over-flowing maternity unit septic tanks

- Advocating for replacement of ageing and inadequate unit plumbing – so far unsuccessful
- Continuous provision of bleach for disinfection purposes and soap for cleaning purposes
- Continuous provision of replacement light bulbs in the maternity and in the operating theatre
- Training for unit logistician in a variety of maintenance techniques.
- Provision of storage/shelving in office

- **Major Maintenance projects**
  - Successful advocacy for UNICEF, UNFPA, WHO and MoHSW to repair maternity unit roof and replace ceiling fans and wiring for maternity wards
  - Renovation of doctors on-call room – paid for by a MCAI donor
  - Renovation of maternity unit room to create a maternity triage system – paid for by MCAI donors

- **Equipment provided**
  - Labour Ward
    - Pulse oximeters x 2
    - Sonic-aid doppler ultrasound x 4
    - Manual Vacuum Aspiration (MVA) sets x 2
    - Blood pressure (BP) machines x 6
    - Amniohooks
  - Operating Theatre
    - Manual Vacuum Aspiration (MVA) sets x 13
    - Pulse oximeters x 2
    - Sonic-aid doppler ultrasound x 4
    - Blood pressure (BP) machines x 6
    - Caesarean section instrument set x 1
    - Hager dilator set x 1
    - Hysterectomy clamps x 4
    - Episiotomy scissors x 8
    - Dissecting scissors x 3
    - Mayo scissors x 3
    - Simms speculum x 4
    - Cusco speculum x 4
    - Theatre drapes
  - Large washing machine for laundry – provided by a supporter of MCAI
  - 100 meters of washing line to ensure quick turn-around from laundry
  - Maintenance tools
    - Electric and hand drills and drill parts
    - Full set of screwdrivers
    - Full set of Allen keys
    - Basic tool set
    - Electric meter

Appendix 3: Details of the educational outcomes of the Advanced Obstetric Training Programme

Results of post-foundation training course examination				
Candidate Name	**Exam Component**			**Total Mark**
	OSCE* stations	**Anatomy 'spot exam'****	**SAQ*****	
Dr A Kanteh	85%	77%	96%	**85%**
Mr A Faye	82%	87%	83%	**84%**
Mrs F Camara	76%	84%	53%	**73%**
Dr A Bojang	84%	100%	67%	**84%**
Dr M Sanyang	72%	84%	75%	**76%**
Dr Yorro Bah	91%	100%	94%	**94%**

Red – Denotes 2014/2015 cohort

*OSCE – Objective Structured Clinical Examination

** 'Spot Exam' – Identification of anatomical landmarks on photographs and diagrams

*** SAQ – Short Answer Questions on mechanisms of labour

Procedures performed and recorded by senior midwife trainees in their log-books		
Procedure	**Number Performed**	
	Mr. A Faye (Jan/15-Dec/16)	**Mrs. F Camara (Nov/15 – Training ongoing)**
Vacuum delivery - OA	40	6
Vacuum delivery – OP/OT	10	
Twins delivery	20	4
Breech delivery	29	7
Eclampsia management	*Large no: not recorded*	3
Management of Cord prolapse	5	1
Management of Shoulder dystocia	8	
Episiotomy	37	9
Second degree tear repair	15	
Third degree tear repair	6	
De-fibulation (anterior episiotomy)	5	
4th Degree tear repair - assisted	1	
Cervical tear repair	3	
Post-natal vulval haematoma evacuation/repair	1	
Post-coital vaginal wall tear repair	2	
Condom Tamponade	10	2
Bimanual compression and PPH management	19	4
Manual removal of placenta	7	
Neonatal resuscitation	40	4
External Cephalic Version	5	2
Drainage of hydrocephalus per vagina	2	

Procedures performed and recorded by senior midwife trainees in their log-books		
Procedure	**Number Performed**	
	Mr. A Faye (Jan/15-Dec/16)	**Mrs. F Camara (Nov/15 – Training ongoing)**
Uterine Evacuation - MVA	25	6
Uterine evacuation - Sharp curettage	27	1
I+D Vulval abscess	1	
I+D Breast abscess	2	

Procedures performed and recorded by doctor trainees in their log-books				
Procedure Performed	**Number Performed**			
	Completed Training	**Current trainees – Nov/15 - ongoing**		
	Dr. Kanteh	**Dr. Bojang**	**Dr. Bah**	**Dr. Sanyang**
C/S - assisted	4	3	10	6
C/S – direct supervision	55	17	16	4
C/S – indirect supervision	12			
C/S – complex case	29			
Hysterectomy - assisted	1	1		
Hysterectomy - supervised	2			
Vacuum delivery	18 - *incomplete data*	2	2	2
Bilateral Tubal Ligation	29 - *incomplete data*		8	
Ectopic - assisted	4	2		
Ectopic – direct supervision	7	2		
Ectopic – indirect supervision	3			
Breech Delivery	15	8		4
Twins delivery		4	6	2
Management of Cord prolapse				
Management of Shoulder Dystocia	4			
Condom balloon catheter	7 *incomplete data*		3	
Perineal tear repair			15	4 - Data incomplete
3rd degree tear repair	15	1		
Cervical tear repair	2	1		
Manual removal of placenta	5	1		
Oophrectomy (ovarian cyst)	3			
Marsupilisation Bartholin's abscess	1			
Eclampsia management	*Data not collected*		8	1 - Data incomplete

Procedures performed and recorded by doctor trainees in their log-books				
Procedure Performed	**Number Performed**			
	Completed Training	**Current trainees – Nov/15 - ongoing**		
	Dr. Kanteh	**Dr. Bojang**	**Dr. Bah**	**Dr. Sanyang**
Evacuation – MVA and Curettage		9	22	*2 - Data incomplete*
Dilation and Curettage/MVA		3	1	

Clinical discussions recorded on Formative Assessment Forms: *Trainees who have completed programme – i.e. 2014/2015 cohort (information up to 16 March 2016)*

Note – These cases do not represent all cases managed by the trainee but a small sample of managed cases which were formally discussed with the clinical supervisor in a formative assessment

Mr. Arfang Faye		
Assessment Form Type	**Number Completed**	**Topics covered**
Case Based Discussion	26	Delay 1st stage and use oxytocin
		Abruption + IUFD x 3
		Premature rupture of membranes
		Obstructed labour
		Placenta praevia
		Pyelonephritis
		Pyrexia of unknown origin
		Severe pre-eclampsia x 2
		Genital tract trauma
		Eclampsia
		Severe anaemia/shock post-partum x 2
		Twin Pregnancy
		Epilepsy in pregnancy
		Resus iso-immunisation
		APH – unclear cause
Supervisor Observed Experience	26	2nd trimester IUFD
		Failure to progress x 2
		Previous caesarean section x 2
		Moderate Pre-eclampsia at term x 2
		Severe Pre-eclampsia x 4
		Severe hyper-emesis
		3rd trimester IUFD unknown cause
		Puerperal sepsis secondary to endometritis
		Massive placental abruption +IUFD x 3
		Pneumonia
		Fetal Distress
		Post-partum Eclampsia

Mr. Arfang Faye		
Assessment Form Type	**Number Completed**	**Topics covered**
		PROM and PIH
		Bladder over-distention in labour
		Severe Pre-eclampsia and SOB
Reflective Practice	4	Missed retained placenta in mid-trimester abortion
		Missed Placental abruption
		Delay in management of PPH
		Sub-optimal management of team

Dr. Abdulhamid Kanteh		
Assessment Form Type	**Number Completed**	**Topics covered**
Case Based Discussion	25	PPH secondary to cervical tear
		Mid-trimester IUFD x 2
		Prolonged rupture of membranes
		Severe pre-eclampsia x 3
		Pneumonia and pulmonary oedema
		Heart failure post-partum
		Twin pregnancy
		HELLP syndrome
		Epilepsy in pregnancy
		Pre-term labour and polyhydramnios
		Cord prolapse
		Oligohydramnios
		Breech presentation
		Unsafe abortion
		Premature pre-labour rupture of membranes
		Ruptured ectopic and hypovolaemic shock
		Prolonged early labour
		Heart failure
		Cornual ectopic
		Hydrocephalus
Supervisor Observed Experience	20	Severe pre-eclampsia x 2
		Moderate pre-eclampsia at term
		Endometritis and retained products of conception
		APH and pre-labour rupture of membranes
		Failed induction of labour with misoprostol
		Abruption + IUFD x 2
		Eclampsia x 2
		Sepsis
		Cord prolapse and footling breech
		Pneumonia
		Prolonged rupture of membranes and twins

Dr. Abdulhamid Kanteh		
Assessment Form Type	**Number Completed**	**Topics covered**
		Resus iso-immunisation
		Meningitis
		Suspected ectopic pregnancy
		Missed abortion 1st trimester
Reflective Practice	6	Delayed management of deteriorating patient
		Prioritising work-load when busy
		Consider resuscitation status early
		Eclampsia in admitted patient
		Delay in recognition of an ectopic pregnancy

Clinical Discussions recorded on Formative Assessment Forms: *Trainees who are currently undergoing training – i.e. 2015/2016 cohort*

Mrs. Fatou Camara		
Assessment Form Type	**Number Completed**	**Topics Covered**
Case Based Discussions	16	Timing of episiotomy
		Obstructed labour x 2
		APH – mild abruption
		Severe pre-eclampsia x 2
		Sudden death in pre-eclampsia patient
		Septic abortion
		Massive PPH
		Incomplete abortion x 2
		Delayed second stage
		Ruptured uterus
		Massive PPH post caesarean section
		Twins
		Breech delivery
Supervisor Observed Experience	5	Anencephaly
		Severe pre-eclampsia + abruption
		Cord prolapse
		Delayed second stage
		Prolonged rupture of membranes
Reflective practice	3	Delay in recognition of bleeding post-caesarean section
		Delay in diagnosis of uterine rupture
		Failure of antenatal care team

Dr. Abdou Bojang		
Assessment Form Type	**Number Completed**	**Topics Covered**
Case Based Discussions	6	Malaria in pregnancy
		Twin delivery and Breech Delivery
		Severe pre-eclampsia
		Post-partum eclampsia
		Severe PET with pulmonary oedema
		Abruption + IUFD
Supervisor Observed Experience	3	Abruption, IUFD, severe pre-eclampsia
		Molar pregnancy
		Cord prolapse
Reflective practice	0	

Dr. Mohammed Sanyang:		
Assessment Form Type	**Number Completed**	**Topics Covered**
Case Based Discussions	6	Twins and PIH
		Severe malaria in pregnancy
		APH – unclear cause
		Severe pregnancy induced hypertension
		Severe pre-eclampsia x 2
Supervisor Observed Experience	4	Obstructed labour and fetal distress
		Anaemia in pregnancy ? cause
		Post-partum haemorrhage
		Puerperal sepsis + ?puerperal psychosis
Reflective practice	2	Severe pre-eclampsia not treated with MgSO4
		Missed case of severe pre-eclampsia in a patient presenting with abruption

Dr. Yorro Bah		
Assessment Form Type	**Number Completed**	**Topics Covered**
Case Based Discussions	11	Ante-natal breech and ECV
		Prolonged rupture of membranes at term
		Severe PET and mild APH at term
		Abruption and IUFD
		Malaria in pregnancy
		Mid-trimester IUFD ? cause
		Eclampsia

Dr. Yorro Bah		
		Severe Pre-eclampsia
		Footling breech
		Post-partum haemorrhage
		Missed Abortion 1st trimester
Supervisor Observed Experience	0	
Reflective practice	0	

PATIENT'S NAME:

DATE OF BIRTH
OR AGE:

DATE OF
EVENT:

GESTATION IN WEEKS
OR
POSTNATAL AGE IN DAYS

NAME OF LEAD
PERSON UNDERTAKING
MANAGEMENT

NAME (S) OF ADDITIONAL
TEAM MEMBERS UNDERTAKING
MANAGEMENT

NAME LIFE-THREATENING CONDITION
AND DESCRIBE CLINICAL SITUATION

AT TIME OF ONSET OF INTERVENTION:
Pulse rate:
Respiratory rate:
BP:
Temp:
WAS SHOCK PRESENT?

DESCRIBE THE
CLINICAL MANAGEMENT
INCLUDING ANY PROCEDURES
AND DRUGS USED

HOW LIKELY DO YOU THINK IT IS THAT WITHOUT THE TREATMENT GIVEN THIS
PATIENT WOULD HAVE DIED? ON A SCALE 1-10 WITH 10 BEING THE MOST LIKELY TO HAVE DIED

DESCRIBE ANY CLINICAL MANAGEMENT GIVEN TO THE BABY/BABIES IF BORN DURING OR
AFTER CLINICAL MANAGEMENT OF THE MOTHER
Bag and mask?
Chest compressions/
Drugs?
KMC?
Glucose?

DID BABY SURVIVE?

LIFE THREATENING EMERGENCY FORM
BRIKAMA MHC 1/4/15 TO 31/7/15

APPENDIX 4

Appendix 5 analysis of life threatening maternal emergencies April to July 2015

CODE FOR TABLE RE: Baby A = alive baby: Tr = Intrauterine transfer or discharge and baby outcome unknown: I = Intrauterine fetal death on arrival at BMHC; SB = Fetus alive at onset of management in BMHC; n/a = not applicable; Misc. = miscarriage; Ectopic = ectopic pregnancy; Post-del adm = Mother admitted sometime after delivery; DIC = disseminated intravascular coagulation

Prem = premature fetus; ERPC = Evacuation retained products of conception; CS = caesarean section

Patient Code	Date	Category	Serious Maternal Complication Type						Baby	Management					
			Severe Pre-eclampsia/ Eclampsia (E)	Severe Haemorrhage P= Postnatal A= Antenatal	Severe Infection	Ruptured uterus	Severe complications of abortion (include Ectopic)	Maternal death		MgSO4	Hydr /Nifed	Blood Transf	IV ABs	PPH Mx Uterotonics Condom catheter	Brief Other
MONTH APRIL 2015															
1	11	1+2		✓P					A			✓			Post-del adm
2	11	1+2		✓P		✓			A			✓			Hysterectomy for ruptured uterus
3	01	1	✓						A	✓	✓				
4	03	1	✓						Tr	✓	✓				Premature/steroids given
5	04	1	✓						I	✓	✓				
6	05	2							Tr			✓			
7	07	1+2	✓	✓A			DIC /Prem		Tr	✓	✓	✓			Transfer
8	07	1+2		✓P					I			✓		✓	Post-del adm
9	07	1+2					Ectopic		Ect			✓			Laparotomy
10	06	1+2	✓	✓A					A	✓	✓	✓			DIC
11	07	1+2		✓P			Incomplete Abortion		n/a			✓			
12	08	1		✓A					Tr			?			Major placenta praev No scrub nurse
13	12	1	✓						Tr	✓	✓				Prem /steroids given
14	15	2							Tr			✓			
15	12	1+2	✓	✓A ✓P					I	✓		✓	✓	✓	DIC
16	12	1+2		✓P					A			✓		✓	Post-del adm
17	13	2							Tr			✓			AN
18	16	1+2	✓						A	✓	✓	✓			
20	17	1+2		? ✓P					I			✓		?	DIC Hard to read notes
21	18	1+2		? ✓P					A			✓			

Appendix 5 analysis of life threatening maternal emergencies April to July 2015

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Prem = premature fetus; ERPC = Evacuation retained products of conception; CS = caesarean section

Patient Code	Date	Category	Serious Maternal Complication Type						Baby	Management					
			Severe Pre-eclampsia/ Eclampsia (E)	Severe Haemorrhage P= Postnatal A= Antenatal	Severe Infection	Ruptured uterus	Severe complications of abortion (include Ectopic)	Maternal death		MgSO4	Hydr /Nifed	Blood Transf	IV ABs	PPH Mx Uterotonics Condom catheter	Brief Other
22	15	1+2	✓E	✓A ✓P					I	✓	?	✓		✓	Condom Tamponade
23	16	1+2		✓P					I			✓		✓	
24	19	1	✓						A	✓	✓				
25	15	1+2		✓P					A			✓		✓	
26	01	2							A			✓			Post-del adm
27	03	1+2		✓P					A			✓		✓	
28	21	1	✓						SB	✓	✓				
29	10	1+2		✓P					n/a			✓			Post-del adm
30	18	1	✓E						A	✓	✓				Post-del adm
31	22	1	✓						A	✓	✓				
32	24	2							??			✓			Post-del adm
33	29	1+2		✓P					A			✓		✓	
34	20	1	✓						A	✓	✓				
35	22	1+2		✓A					I			✓			
36	22	1	✓						A	✓	✓				
37	22	1+2			✓				n/a			✓	✓		Post-del adm
38	23	1+2					Incomplete Abort		Misc			✓			ERPC
39	24	1	✓						A	✓	✓				
40	27	2							Tr			✓			AN
41	28	1		✓P					A			?		?	Uterine inversion Notes missing
42	30	1+2	✓E	✓P					A	✓	✓	✓		✓	
44	30	1+2		✓P					n/a			✓		✓	Vaginal Haematoma Post-del adm
47	30	1+2		✓P					n/a			✓		✓	Post-del adm

Appendix 5 analysis of life threatening maternal emergencies April to July 2015

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			Severe Pre-eclampsia/ Eclampsia (E)	Severe Haemorrhage P= Postnatal A= Antenatal	Severe Infection	Ruptured uterus	Severe complications of abortion (include Ectopic)	Maternal death		MgSO4	Hydr /Nifed	Blood Transf	IV ABs	PPH Mx Uterotonics Condom catheter	Brief Other
52	29	1	✓						I	✓	✓				
A1	01	1+2 +4	✓	✓A				✓	I	✓	✓	✓			DIC Transfer Died at EFSTH
94	12	1+2	✓	✓A					I	✓		✓			
92	16	1	✓						A	✓	✓				
93	16	1	✓						Tr	✓	✓				Transfer
91	20	1	✓E						A	✓	✓				CS
90	24	1	✓						I	✓	✓				
89	24	1	✓						Tr	✓	✓				Prem/Dex Transfer
87	27	1	✓E						A	✓	✓				Post-del
88	27	1	✓						A	✓	✓				Post-del
86	28	1	✓						I	✓	✓				
85	28	1	✓						Tr	✓	✓				Prem/Dex Transfer
97	02	1+2		✓A	✓				I			✓ 6units	✓		Post natal Readmitted x 4 Severe DIC
Month	**MAY 2015**														
43	01	1+2		✓P					n/a			✓		✓	Post-del adm
45	01	1+2		?✓P					A			✓			PN Collapse
46	08	1	✓						Tr	✓	✓				Prem/Dex Transfer
48	02	1+2		✓					I			✓			Prem/DIC Transfer
49	04	1	✓						Tr	✓	✓				Prem/Dex Transfer
50	05	1			✓				A				✓		PN
51	05	2							Tr			✓			AN
53	15	1+2		✓A					A			✓			

Appendix 5 analysis of life threatening maternal emergencies April to July 2015

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Prem = premature fetus; ERPC = Evacuation retained products of conception; CS = caesarean section

Patient Code	Date	Category	Serious Maternal Complication Type						Baby	Management					
			Severe Pre-eclampsia/ Eclampsia (E)	Severe Haemorrhage P= Postnatal A= Antenatal	Severe Infection	Ruptured uterus	Severe complications of abortion (include Ectopic)	Maternal death		MgSO4	Hydr /Nifed	Blood Transf	IV ABs	PPH Mx Uterotonics Condom catheter	Brief Other
54	10	1+2	✓						I	✓	✓	✓			
55	10	1+2		✓P					A			✓		✓	
56	08	1+2		✓			Ruptured Ectopic		n/a			✓			Laparotomy
57	13	1+2		✓A					A			✓			
58	11	1+2	✓	✓A					I	✓	✓	✓			
59	05	1			✓				n/a				✓		Post-del adm
60	13	1		✓A					Tr			?			?Placenta praevia No anaesthetist
61	16	1+2		?✓P					n/a			✓			Post-del adm
62	15	1+2		?✓P					n/a			✓			Post-del adm
63	26	1	✓						A	✓	✓				
64	26	1	✓E						Tr	✓	✓				
65	26	1+2		✓A					Tr			✓			Prem 35 weeks
67	25	1	✓	✓A	?				Tr	✓			✓		Prem/steroids No anaesthetist
68	25	1		✓A					I						Placenta praevia Prem 34 weeks No anaesthetist
69	24	1	✓						SB	✓	✓				Term /IUFD Transfer
70	22	1+2	✓E	✓P					A	✓	✓	✓	✓		
71	21	1+2		?✓P					A			✓			
72	18	1+2	?	✓A					I			✓			Hb 3.3
73	21	1	✓E						A	✓	✓				

Appendix 5 analysis of life threatening maternal emergencies April to July 2015

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Patient Code	Date	Category	Serious Maternal Complication Type						Baby	Management					
			Severe Pre-eclampsia/ Eclampsia (E)	Severe Haemorrhage P= Postnatal A= Antenatal	Severe Infection	Ruptured uterus	Severe complications of abortion (include Ectopic)	Maternal death		MgSO4	Hydr /Nifed	Blood Transf	IV ABs	PPH Mx Uterotonics Condom catheter	Brief Other
74	18	1+2	✓	✓A					A	✓	✓	✓			
75	29	1	✓						Tr	✓	✓				Fetal distress 36/40Transfer No anaesthetist No blood tech.
76	29	1+2	✓	✓A					I	✓	✓	✓			
78	28	1	✓						Tr	✓	✓				Fail to progress at 8cm No anaesthetist
79	27	1+2	✓	✓A ✓P					I	✓	✓	✓		✓	
80	26	1+2		✓P					n/a			✓		?	Post-del adm
81	15	1	✓					✓****	I		✓				Fetal distress and abruption ****
82	18	2							A			✓			Post-del
83	27	2		?					A			✓			Post-del
84	27	1		✓P	✓				A				✓	✓	Condom tamponade
95	02	1	✓E						A	✓	✓				Post-del
96	09	1	✓						I	✓	✓				
98	31	1	✓						A	✓	✓				
99	18	1+2	✓E	✓P					I	✓	✓	✓6u		✓	Condom tamponade
100	18	1	✓						A	✓	✓				
101	30	1	✓						A	✓	✓				
102	19	1	✓						A	✓	✓				

**** Patient 81 delivered at EFSTH. Subsequent readmission 1 month later to BMHC with sepsis? pneumona and maternal death

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Prem = premature fetus; ERPC = Evacuation retained products of conception; CS = caesarean section

Patient Code	Date	Category	Serious Maternal Complication Type						Baby	Management					
			Severe Pre-eclampsia/ Eclampsia (E)	Severe Haemorrhage P= Postnatal A= Antenatal	Severe Infection	Ruptured uterus	Severe complications of abortion (include Ectopic)	Maternal death		MgSO4	Hydr /Nifed	Blood Transf	IV ABs	PPH Mx Uterotonics Condom catheter	Brief Other
Month	**JUNE**														
J1	01	1	✓						A	✓	✓				
J2	03	1	✓						A	✓	✓				
J3	04	1+2	✓	✓A✓P					?I	✓		✓	✓		Fail to progress and CS
J4	04	1	✓						A	✓	✓				
J5	06	1	✓						A	✓	✓				
J6	07	1+2		✓			Incomplete Abortion		misc			✓			ERPC
J7	08	1	✓						Tr	✓	✓				Prem
J8	08	1+2		✓P					I			✓		✓	Post-del adm
J9	08	1	✓						Tr	✓	✓				Previous CS
J10	09	1+2		✓			Rup Ectopic		Ect			✓			Laparotomy
J11	10	2							Tr			✓			Prem triplets
J12	12	1			✓				Tr				✓		?Tooth Abscess
J13	14	1+2		✓P					A			✓		✓	
J14	14	1		?✓A					Tr			?			Twins
J15	17	1+2		✓P					A			✓		✓	
J16	17	1		✓P					A x2			?		✓	Twins
J17	12	1+2		✓A					Tr			✓			Twins/ footling breech Transfer

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Prem = premature fetus; ERPC = Evacuation retained products of conception; CS = caesarean section

Patient Code	Date	Category	Serious Maternal Complication Type						Baby	Management					
			Severe Pre-eclampsia/ Eclampsia (E)	Severe Haemorrhage P= Postnatal A= Antenatal	Severe Infection	Ruptured uterus	Severe complications of abortion (include Ectopic)	Maternal death		MgSO4	Hydr /Nifed	Blood Transf	IV ABs	PPH Mx Uterotonics Condom catheter	Brief Other
J18	12	1	✓						A	✓	✓				
J19	13	1	✓E (x 4 conv)						A						Diazepam and high spinal with delayed intubation and hypoxia
J20	16	2				✓			n/a			✓			Post-del adm
J21	16	1+2			✓	✓			n/a			✓	✓		Post-del adm
J22	18	2	✓						A	✓	✓				
J23	20	2				✓			A			✓		✓	Post-del adm
J24	22	1							n/a						Early pregnancy-abdominal mass
J25	23	1+2	✓	✓P					A	✓	✓	✓			
J26	26	1+2		✓A					Tr			✓			Prem
J29	27	1	✓						A	✓	✓				Post-del adm
J30	30	1	✓						A	✓	✓				
J31	25	1+2		✓P					n/a			✓		✓	Post-del adm
J32	08	1+2		✓			? Ectopic		Tr			✓			
J33	17	1			✓				A						?endocarditis
Month	**JULY**														
JU1	03	2							I			✓			ERPC Delayed clotting time
JU 2	05	1	✓E						A	✓					Confusion pre delivery
JU3	05	1+2	✓	✓A					I	✓		✓			Delayed clotting

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			Severe Pre-eclampsia/ Eclampsia (E)	Severe Haemorrhage P= Postnatal A= Antenatal	Severe Infection	Ruptured uterus	Severe complications of abortion (include Ectopic)	Maternal death		MgSO4	Hydr /Nifed	Blood Transf	IV ABs	PPH Mx Uterotonics Condom catheter	Brief Other
JU4	06	1	✓						A	✓	✓				CS
JU5	07	1+2		✓P					A			✓	✓	✓	Condom tamponade
JU6	07	1+2		✓P					A&I			✓	✓	✓	Condom tamponade Twin2 delivery
JU7	09	1+2	✓						I	✓		✓			DIC/abruption
JU8	10	1+2		✓A					A			✓			Placenta Praevia CS
JU9	10	1	✓E						I	✓	✓				
JU10	12	1+2		✓P	✓				I			✓	✓	✓	
JU11	12	2							A			✓			Fail to progress CS
JU12	13	1+2			✓PN				I			✓	✓		Laparotomy
JU13	14	1+2		✓			Ruptured Ectopic		n/a			✓			Laparotomy
JU14	15	2							n/a				✓		Laparotomy? preg /torsion ovarian cyst
JU15	18	1+2	✓E	✓P					A	✓	✓	✓			
JU16	19	1+2		✓P					A			✓		✓	
JU17	22	1	✓E						Tr	✓	✓				Twins/CS Prem/steroids
JU18	23	1+2					Ruptured Ectopic		n/a						Laparotomy
JU19	23	1	✓						A	✓	✓				
JU20	23	1	✓						A	✓	✓			✓	
JU21	23	2							n/a			✓			Post-del adm
JU22	25	2										✓			CS Small APH Placenta Praevia
JU23	26	1+2		?✓ P					n/a			✓		✓	Post-del adm

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			Severe Pre-eclampsia/ Eclampsia (E)	Severe Haemorrhage P= Postnatal A= Antenatal	Severe Infection	Ruptured uterus	Severe complications of abortion (include Ectopic)	Maternal death		MgSO4	Hydr /Nifed	Blood Transf	IV ABs	PPH Mx Uterotonics Condom catheter	Brief Other
JU24	24	1	✓						Tr	✓	✓				Prem/steroids
JU25	24	1+2	✓	✓A					A	✓	✓	✓			Transfer with baby Prem/ DIC
JU26	24	1			✓				SB				✓		
JU27	26	1+2		?✓P					A			✓			Post-del adm
JU28	27	2							Tr			✓	✓		Early pregnancy urinary infection
JU29	30	1							Tr	✓	✓				Prem/steroids
JU31	30	1+2	✓	✓A					I	✓	✓	✓			
JU32	17	1+2		✓P					I			✓	✓	✓	PPH in taxi

Obstetric Training Programme Brikama Major Health Centre

Expenditure by MCAI 1 November 2014 - 31 December 2015 in £ UK

	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15		Total £
Emergency Drugs	201		741	226	552	686	135	217	318	239		99	701	391		**4,506**
Medical and surgical supplies	1,088	3,343	786	1,328		97	303	1,343	506	733		429		1,430		**11,386**
Medical Equipment		2,117	22	410	137	181	219				408	371		93		**3,957**
Non-medical equipment	218	272	1,729		34	91	62		30				71	44		**2,551**
Incentives for staff			241	245	245	188	179	179	192	194	193	266	388	565		**3,075**
Maintenance and development of Health centre	1,235	590	890		136	-491	184	878	139	329		-10	-962			**2,918**
Accommodation costs for International staff	1,400	1,530	450		598	72	428	915	456	247	527		1,860	97		**8,580**
International staff travel and insurance	1,417		331	1,438	1,913	4,365	766	618	1,900	50		752	5,281	361		**19,192**
International staff per diem and R&R costs	305	305	307	187	317	220	1,843		535	704	1,527	255	1,181			**7,686**
Teaching materials / printing		31	26	246		100							305	10		**718**
Fundraising costs - Just giving and PayPal fees						4							19	3		**27**
	5,863	**8,189**	**5,523**	**4,080**	**3,932**	**5,514**	**4,119**	**4,150**	**4,076**	**2,496**	**2,655**	**2,161**	**8,844**	**2,995**		**64,596**

Emergency Drugs purchased																
	Nov-14	**Dec-14**	**Jan-15**	**Feb-15**	**Mar-15**	**Apr-15**	**May-15**	**Jun-15**	**Jul-15**	**Aug-15**	**Sep-15**	**Oct-15**	**Nov-15**	**Dec-15**		**Total**
Misoprostol	201							120								**321**
Ephedrine			15											23		**38**
Diprivan			105													**105**
Heavy Marcain			55						22							**76**
Oxytocin			566	226		566										**1,358**
Furosemide					28			7				23				**59**
Paracetamol								35								**35**
Diazepam					25			4								**30**
Tramodol					49				16	46		25	37			**174**
Propofol									11	22						**33**
Lidocaine					95											**95**
Metronidazole					28				37							**65**
Hand sanitiser					74		55	35								**164**
Iodine solution					35					26			55			**116**
Povidone iodine													46	38		**84**
Nifidi-denk					17		10	8	26	9		20				**90**
Diclo-denk					35		35			37			45			**152**
Hydrocortisone																

					23							13	14	12		**62**
Breeze antibacterial					18		30									**47**
Chlorohexadrine solution									37							**37**
Ceftriazone solution									109	11			16	230		**367**
Mephaquine									16							**16**
Bupivicaine										88		17	65			**171**
Cetrimide & Chlorohexidine solution														28		**28**
Other small value drugs					125		6	6	44				219			**400**
Essential medicines						115										**115**
Nefidipene & Hydrazeline						4							43			**47**
Antibiotics													22			**22**
Malarone													88			**88**
Urine test strips													50	59		**109**
	201	**-**	**741**	**226**	**552**	**686**	**135**	**217**	**318**	**239**	**-**	**99**	**701**	**391**		**4,505**

Medical and surgical supplies																
	Nov-14	**Dec-14**	**Jan-15**	**Feb-15**	**Mar-15**	**Apr-15**	**May-15**	**Jun-15**	**Jul-15**	**Aug-15**	**Sep-15**	**Oct-15**	**Nov-15**	**Dec-15**		**Total**
Gauze swabs	117			75												**192**
Gloves	427									12		22				**461**
Supplies	462															**462**
Urine dipsticks		433														**433**
Spinal needles		254								44						**298**
Supplies		2,657	410													**3,067**
IV Cannulae			126							51						**177**
Essential supplies	82					83										**165**
Office supplies for ward						14										**14**
Sutures			162	1,253			183	1,267	458	585		392		1,358		**5,658**
Catheters			88				120	44	48	41		15		72		**428**
Liner bags								33								**33**
	1,088	**3,343**	**786**	**1,328**	**-**	**97**	**303**	**1,343**	**506**	**733**	**-**	**429**	**-**	**1,430**		**11,387**

Medical Equipment																
	Nov-14	**Dec-14**	**Jan-15**	**Feb-15**	**Mar-15**	**Apr-15**	**May-15**	**Jun-15**	**Jul-15**	**Aug-15**	**Sep-15**	**Oct-15**	**Nov-15**	**Dec-15**		**Total**
Specula, flexiport cuff, BP gauge & cuff		96														**96**
Zeppelin clamps		216														**216**
Timers and thermometers		71														**71**
Patient Transfer sheets		124														**124**
Autoclave		600														**600**
Temperature indicators		28														**28**
Sonic Aids		694														**694**
Posterior suction cup, CS kit		289														**289**
Pulse oximeter, import duty			22													**22**
Curettes, Episiotomy, Mayo nd dissecting scissors				206												**206**
Dilators				104												**104**
BP valves and cuffs				55												**55**
MVA set & ECG electrodes				45												**45**
Pregnancy wheel					8											**8**
Vacuum cups					129											**129**
Stethoscopes						181										**181**
Ultrasound replacement battery							141									**141**
Headtorch																

							77									**77**
Parts for Arfang device											408	371		69		**848**
Sheets for on-call room														24		**24**
	-	**2,117**	**22**	**410**	**137**	**181**	**219**	**-**	**-**	**-**	**408**	**371**	**-**	**93**		**3,955**