Ten years of reducing maternal, neonatal, infant, child and adolescent mortality and improving quality of health care through a national task-sharing program in public hospitals in Liberia

Summary

Part 1

To improve hospital-based maternal and neonatal care throughout Liberia, a Partnership operating under a Memorandum of Understanding between the Liberian Ministry of Health, WHO Liberia, UNFPA Liberia and the Scottish charity, MCAI, agreed in 2013 to start an innovative task-sharing project in advanced hospital based obstetric care and, later, additional task-sharing projects in advanced neonatal and paediatric care. The task-sharing program has also expanded to include obstetric outreach in 4 counties (see appendix 1) and a program involving fetal monitoring by mothers in partnership with staff aimed at reducing birth asphyxia began in 2016 and the results of 6398 participating mothers attending 4 rural public hospitals are described in a separate Report (Part 2).

Experienced midwives and nurses were selected by representatives of the Partnership to undertake extensive training and rigorous continuous assessment, to become qualified obstetric clinicians (after three years), qualified neonatal clinicians (after two years) and qualified paediatric clinicians (after 2 years and 3 months). At the end of their training, each qualified obstetric clinician was capable of safely and independently performing advanced obstetric care, including abdominal surgery. The neonatal and paediatric clinicians undertake advanced hospital neonatal and paediatric care, respectively.

By the beginning of 2024, 28 obstetric clinicians and 17 neonatal clinicians are working in 9 rural hospitals. The qualified neonatal clinicians have delivered neonatal resuscitation training to skiiled birth attendants in BEmONC facilities (see Appendix 2). The first cohort of 12 trainee paediatric clinicians are due to qualify in May 2024.

These 3 training programs have required considerable logistic input, substantial financial commitment, and political support, but importantly, have already contributed to improved maternal, neonatal and child healthcare throughout Liberia, helping to save and improve the lives of many Liberian women (and adolescent girls), their babies and their children.

As part of the task-sharing programme, nurse anaesthetists in the hospitals where obstetric clinicians are based in remote areas have received enhanced training and mentorship funded and provided by MCAI (see Appendix 3).

The programs have received funding from the Burdett Trust (through the University of Edinburgh), Irish Aid, MCAI, UNFPA Liberia, UNICEF, The Advanced Life Support Group, The DAK Foundation, and WHO Liberia but substantial further funding is now urgently required as more clinicians are needed in hospitals throughout Liberia.

This report describes these training programs, shares the experiences of those involved, and highlights their impact.

Key messages resulting from this maternal, neonatal and child health hospital-based task sharing program.

1. According to a recent (August 2023) USAID report from Liberia, the current Maternal Mortality Rate in Liberia continues to remain extremely high at 742 deaths per 100,000 births (CI: 485-1,000) –DHS 2019/20.

2. The most important way forward in reducing maternal, fetal, neonatal and child deaths involves more support for the work force in the Liberian National Public Health Service (NHS). Adequate salaries for midwives and nurses who are functioning as obstetric, neonatal, and paediatric clinicians are needed urgently. Most have not received

the enhanced salaries promised after the completion of their training, despite their major contribution to providing CEmONC. Despite failed attempts to provide a part-time BSc course over the last 3 years to help provide professional satisfaction, encouragement, and gratitude to these vital members of the health force team, this crucial development is now hopefully to begin following a recent change in the structure of the Ministry of Health.

3. The existing clinicians, obstetric, neonatal and paediatrics need urgently to be integrated into a part time training program in Liberia and Tubman Universities so they can receive a BSc qualification recognising their additional training.

4. The recently qualified 17 obstetric and neonatal clinicians need a graduation ceremony as soon as possible.

5. Situations that urgently require attention include the 4-year national stock-out of vital emergency drugs and materials which has created avoidable delays and resulted in deaths and major morbidity in babies, mothers, and children.

6. Urgent steps are needed to minimise the number of Intrauterine Fetal Deaths (IUFDs) arising before hospital care.

7. The importance of integrating obstetric, neonatal, paediatric care within and between hospitals, clinics and the community has been demonstrated.

8. Obstetric outreach, involving a kit which includes obstetric ultrasound to assess maternal and fetal well-being, is now underway in 4 rural counties and is showing promising results (see below).

9. Other steps involve enhancing obstetric care in far-to-reach communities through reduction of home births, better roads and ambulance services, better communication with communities concerning the dangers of birth asphyxia, and establishment of CEmONC centres in high population, remote areas such as that in the Konobo district of Grand Gedeh.

10. As identified in other studies in low-income settings, the prevention of obstetric complications, which affect the fetus as well as the mother continue and need attention: these include malpresentations such as breech, eclampsia and severe pre-eclampsia, low birth weight/prematurity, pregnancy in teenage and elderly mothers, Prolonged Rupture of Membranes (PROM) and Preterm Prolonged Rupture of Membranes (PPROM), obstructed labour, prolonged labour, post-date pregnancy and multiple pregnancy.

11. Obstetric clinicians have received special training in obstetric ultrasound which is extremely valuable before and during labour.

12. The lack of well organised blood transfusion services is another preventable factor, currently receiving attention in Sinoe County through a pilot project supported by the Global Blood Foundation and developed by MCAI through volunteer obstetric anaesthetist Dr Diane Watson.

13. Medical conditions such as severe anaemia and malaria in pregnancy need more attention. The use of intravenous iron where there is time before delivery to correct anaemia is inexpensive and safe.

14. Malaria should not be occurring in Liberia, and nets and Intermittent Preventive Treatment IPTp need strengthening. Let us hope that the new malarial vaccine can be introduced into Liberia.

15. Problems within the 2nd stage of labour predominate in the experience reported in Part 2 of our program to prevent birth asphyxia as many mothers only reach hospital when the cervix is fully dilated. By this stage mothers are often exhausted, badly affected by unrelieved pain, and cannot push out their babies. The FHR as part of the WHO partograph and by mothers in this program is also difficult to deliver during the second stage of labour.

16. There is a need for much wider use of vacuum delivery or forceps in helping to minimise delays in delivery, especially where accelerated delivery is required. More of the latest Kiwi devices, including traction control, are about to be provided to Liberia by MCAI to assess their effectiveness in this situation.

17. The levels of fetal heart rate FHR regarded as abnormal or potentially harmful are less than 120 bpm or higher than 160 bpm. However, these figures are only a guide, and, if the mothers or midwives identify a slowing or increase from levels that have been present following a series of uterine contractions, investigation and treatments may and should follow.

18. The presence of FHR changes in the 2nd stage of labour indicates the need for an expert in resuscitation (neonatal clinician, trained midwife or nurse anaesthetist) to be present at delivery. Also there needs to be more support for monitoring FHR during this dangerous stage of labour. The presence of a partner or close relative being with the mother at this time who can contribute to the FHR monitoring maybe particularly helpful.

19. Intravenous paracetamol has already been introduced into 2 of the 4 hospitals with fetal monitoring by mothers and has been accepted as effective in reducing the pain of uterine contractions in labour. However, although relatively inexpensive, it has financial implications and has not been introduced yet by the MOH.

20. We are advocating (see above) for the presence of a close family member to accompany mothers in labour and delivery may also help mothers to cope better with pain control and monitoring and may make it more likely that they can successfully deliver vaginally.

Conclusion

This "task sharing" approach to hospital maternity and neonatal care is feasible and provides a sustainable solution to improving maternal, neonatal, and paediatric healthcare and in saving the lives of pregnant women, their babies, and their children by implementing an innovative training program to meet the challenge of the lack of obstetricians, neonatologists, and paediatricians in rural and poverty-stricken areas of Liberia.

Background

Not enough doctors willing to work in rural public hospitals.

One of the main problems in the provision of hospital care for pregnant women, newborn infants, and children in low-income countries, particularly those in sub-Saharan Africa, is a lack of appropriately trained doctors who can care for patients most at risk of death or serious long-term harmful complications. Such complications include obstetric fistulae in women and adolescent girls who have experienced obstructed labour without access to immediate Caesarean section, and permanent, but preventable, brain damage (cerebral palsy) in children where fetal monitoring has been inadequate, newborn resuscitation has been delayed, or performed incorrectly.

Emergency hospital obstetric, neonatal and paediatric care frequently involves long periods overnight where doctors have to work extremely hard without sleep and when mistakes due to tiredness, can be fatal. Such pressures can usually be endured where there are enough well-trained doctors to provide adequate care, but in situations where doctors are scarce, the rotas required to provide life-saving care 24 hours a day, 7 days a week, are difficult to fulfil and many doctors become "burnt out" as a result. This situation often leads to doctors leaving the country, working only in well-resourced hospitals in cities rather than in rural hospitals, or undertaking private health work where overnight, front-line clinical care is minimal. Some doctors may also decide to accept offers of desk-based jobs from international organizations.

The loss of doctors from front-line clinical care progressively makes the situation worse. It leads, not only to a lack of quality care for patients, but reduced opportunities for junior doctors to become trained by senior experienced specialists in advanced obstetric, neonatal, and paediatric care. There is little doubt that this human resource problem is one of the most serious root causes of maternal, neonatal and child mortality in low-income settings.

There is an extreme shortage of doctors in Liberia; one of the worst situations in the world as shown below.

Box 1

Doctors in Liberia (Population 4.5 million) - Report by Liberian Medical and Dental Council July 2016.

203 Liberian doctors (1 for 22,000 persons) and 95 international doctors.
Total 298 (1 for 15,000 persons) = Liberia has the 4th smallest number of doctors (0.373 doctors for 10,000 people) in the world. WHO recommended Doctor: Patient ratio is 1:1000.

In 2016, 10 obstetricians were based in only 3 of the 15 counties in Liberia, 6 in the Capital City. Of 15 counties in Liberia the most rural each have only 1 or 2 doctors.
There is a proliferation of private facilities: many unregulated.

Many hospital deaths relate to three important areas of delay: 1) delay in recognizing the presence of a life-threatening emergency in the community; 2) delay in reaching a hospital with appropriate facilities and staff to treat the emergency; and 3) delay in recognizing the emergency by staff at the hospital and subsequent delay in providing appropriate emergency treatment and management. If this third area of delay cannot be prevented by having sufficient doctors trained in advanced maternal, neonatal, and paediatric care available 24 hours a day, this situation soon becomes known by the community and consequently, families may decide not to go to a hospital and so mothers may deliver and sometimes die at home, newborn babies and children are not transferred for care.

The anonymized case study provided within the logbook of a trainee obstetric clinician below illustrates the fatal consequences of delay.

Mother aged 28 years, 5th pregnancy with 3 children who was admitted to hospital at 38 weeks' gestation from a county health clinic. She had been in labour for 7 days and given oxytocin (a powerful drug to strengthen contractions of the uterus) during this time. On admission, the head of her unborn baby was stuck in the birth canal due to a brow malpresentation. She was very anaemic and shocked. Immediate ABC resuscitation by a team led by the obstetric clinician was undertaken and she was taken immediately (around 30 minutes following admission) to the operating theatre where a doctor and obstetric clinician undertook emergency caesarean section.

A live male infant was delivered weighing 3.5 Kg needing a period of resuscitation. The uterus was full of blood (more than 1 litre) and there was a posterior rupture of the uterus which was surgically repaired. The mother began to bleed from multiple sites (including vomiting of fresh blood) and despite 6 units of a fresh live donor blood transfusion. This post-partum haemorrhage could not be stopped, and the mother died 2-3 hours after admission.

Task-sharing a possible solution to the above problems.
Given the shortage of doctors, other cadres of health workers can be, and have been in other countries, appropriately trained to assist doctors as part of hospital teams to treat serious medical and surgical problems.

Registered midwives are present in all countries, including those with the smallest number of doctors. In low-income countries, their workload is high and those working in hospitals have, after a few years, great experience in managing normal and abnormal deliveries as well as major complications such as massive haemorrhage, sepsis, shock, or fits (eclampsia). However, they are not trained in the more advanced obstetrics needed to treat a significant proportion of patients with complications. By enhancing the training of senior experienced midwives in advanced obstetrics, including abdominal surgery, to work as a team with the small number of doctors available, a task-shifting approach can provide improved obstetric care, particularly in rural district hospitals.

Midwives, unlike most doctors, are rooted in their communities and are extremely unlikely to migrate to seek better pay and conditions. Unlike most physician assistants/medical officers, midwives usually have a strong grounding in maternity care.

Similar arguments apply to the provision of hospital-based quality neonatal and paediatric care provided by appropriately trained nurses. At present most such care relies on midwives, nurses, or nurse assistants inexperienced in advanced neonatal and / or paediatric care. A task-sharing approach to create advanced neonatal and paediatric nurse clinicians is easier to achieve over a shorter duration of time than training in advanced obstetrics, which has a major surgical component.

High quality, comprehensive neonatal care relies on effective obstetrics and a combined task-sharing approach that encompasses both advanced obstetric and advanced neonatal hospital care can be particularly effective.

WHO estimates a projected shortfall of 18 million health workers by 2030, mostly in low- and lower-middle income countries.

Box 2

[Liberian data

Accurate data is difficult to obtain in low resource settings, but those below give a general impression of the significant need in Liberia

Population: 5,057,677 Life expectancy 64 years

27.5% access to electricity, 26% using the internet, 44% in poverty <$1.90/day, 6% SAM [Ref].

WHO/UNICEF/World Bank Data 2022 for Liberia

Maternal Mortality Rate 1072 per 100,000 live births
(UK maternal mortality rate 7 per 100,000 live births)

Neonatal Mortality Rate 30.56 per 1000 live births
(UK neonatal mortality rate 2.7 per 1000 live births)

Under 5yr Mortality Rate 78.28 per 1000 live births
(UK under 5yr mortality rate 4.2 per 1000 live births)

<u>Understanding SAM and its Importance on a Population Basis.</u>

The weight and height of children under 59 months are used as proxy measures for the general health of the entire population. Weight-for-height (wasting) provides the clearest picture of acute malnutrition in a population at a specific point in time. Moderate Acute Malnutrition (MAM) is identified by moderate wasting.WFH -3 z-score for children 0-59 months (or for children 6-59 months, MUAC 115 mm).Severe Acute Malnutrition (SAM) is identified by severe wasting WFH <15% *WHO. 2000. The Management of Nutrition in Major Emergencies*

Box 3 Definitions used in this report (based on Liberia being a low resourced country.

Stillbirth= A baby born at or after 28+0 weeks' gestational age showing no signs of life, irrespective of when death occurred.

Antepartum stillbirth (intrauterine fetal death IUFD =A baby born at or after 28+0 weeks' gestational age showing no signs of life and known to have died before the onset of care in labour.

Intrapartum stillbirth= A baby born at or after 28+0 weeks' gestational age showing no signs of life and known to have been alive at the onset of care in labour.

Neonatal death =A liveborn baby (born at 28+0 weeks' gestational age or later, or with a birthweight of 400g or more where an accurate estimate of gestation is not available), who died before 28 completed days after birth.

Early neonatal death = A liveborn baby (born at 28+0 weeks' gestational age or later, or with a birthweight of 400g or more where an accurate estimate of gestation is not available) who died before 7 completed days after birth.

Late neonatal death =A liveborn baby (born at 28+0 weeks' gestational age or later, or with a birthweight of 400g or more where an accurate estimate of gestation is not available) who died after 7 completed days but before 28 completed days after birth.

Perinatal death =A stillbirth or early neonatal death.

Termination of pregnancy =The ending of a pregnancy, normally carried out before the embryo or fetus is capable of independent life.]

Box 4 Maternal death WHO definitions.
A **Pregnancy – related death** is defined as a death occurring in a Woman while pregnant or within 42 days of the end of the pregnancy, irrespective of the cause of death.

A **Direct maternal death** is defined as a death resulting from obstetric complications of the pregnant state (pregnancy, labour & puerperium), from interventions, omissions, treatment, or from a chain of events resulting from any of the above.

An **Indirect maternal death** is defined as a death that results from previous existing disease, or disease that developed during pregnancy and which was not due to direct obstetric causes, but which was aggravated by the physiological effects of pregnancy.

A **Coincidental maternal death** is defined as a death that occurs from unrelated causes which happens to occur in pregnancy or puerperium e.g. road traffic accident.

A **Late maternal death** is defined as a death that occurs between 42 days and one year after abortion, miscarriage or delivery that is due to direct or indirect maternal causes.

A maternal death may therefore include those Women who die following a miscarriage, termination of pregnancy, suicide from postnatal depression, death from cardiac disease or any medical disorder, ectopic pregnancy, following a surgical procedure and following a road traffic accident.]

PART 1 TASK-SHARING IN LIBERIA

Background
In 2013 MCAI began a series of projects aimed at reducing the extremely high and unacceptable neonatal and maternal mortality rates in Liberia. These rates are also from our experience extremely inaccurate and serious under-reporting of deaths was present at this time. The causes of deaths related to extreme poverty, lack of doctors and midwives, especially in rural areas. In addition, lack of basic equipment, drugs and supplies in all public hospitals made it impossible to provide safe and effective care for the newborn infant and pregnant mother.

The concept of task-sharing as defined by WHO as follows was introduced *"The rational re-distribution of tasks among health workforce teams. Specific tasks are moved, where appropriate, from highly qualified health workers to health workers who have fewer qualifications in order to make more efficient use of the available HRH."* [WHO, 2008]

The development of task-sharing in Liberia has included the training of obstetric, neonatal, and paediatric clinicians (Part 1), obstetric outreach, nurse anesthetist mentorship, and the recruitment of mothers during labour to work with midwives, obstetric and neonatal clinicians, and doctors to enhance fetal monitoring (Part 2).

Training programs to provide the workforce for hospital-based task sharing.
Potential trainees to become trained as hospital experts as obstetric, neonatal, and paediatric clinicians were identified by their county health teams and selected following interviews and examinations in basic emergency obstetric, neonatal, and paediatric hospital care, as appropriate for the clinician category.

They were interviewed by staff from MCAI, MOH, The Liberian Board for Nursing and Midwifery (LBNM), UNFPA and WHO in Monrovia. They were recruited from rural counties and once trained to establish advanced hospital care for infants, children and adolescents returned to work in their local rural county public hospitals.

During their training, clinicians were funded the low basic nursing or midwifery salary by the Ministry of Health (250 USD per month) supplemented by MCAI with 150 USD educational incentive every month and provided with secure accommodation close to their training hospitals by MCAI. For trainee obstetric clinicians, accommodation was

provided in Monrovia (for training at Redemption Hospital) and in Gbargna (for training at CB Dunbar Hospital). For trainee neonatal clinicians, accommodation was provided in the same security guarded and renovated house in Gbargna (for training both obstetric and neonatal clinicians at CB Dunbar Hospital). Trainee paediatric clinicians were accommodated in a secure house renovated by MCAI in the grounds of the training hospital in Bong County (Phebe).

Once they had successfully completed their training programs, qualified clinicians were granted a five-year license by the Ministry of Health to work in public hospitals selected by the Ministry. It was made clear to them that they would not be licensed to work either in Monrovia (the capital city where there is a high concentration of doctors) or in private facilities.

The 3 training programs follow curricula on obstetrics (link here) , neonatal (link here) and paediatric (link here) hospital care, developed by MCAI with technical input from WHO and approved by the Partnership. Links to each curriculum as PDFs are available and on-line from the MCAI website.

Training is undertaken in two ways:

1. Apprenticeship-based, involving, as appropriate for each clinician category, pregnant women, newborn infants and children in outpatient clinics, emergency rooms and in the wards of the training hospitals. For obstetric clinicians training also occurred in the labour and delivery wards and in the operating theatre. The neonatal unit at CB Dunbar Hospital was used to train the 17 neonatal clinicians. The newly renovated hospital paediatric unit and emergency room at Phebe Hospital was/is used for training the first 12 paediatric clinicians.

   The training programs began with specific foundation courses (see links here: obstetrics, neonatal and paediatric care) after successful completion of which, the trainees moved on to apprenticeship-training.

   Training also involves handover meetings (where trainees and qualified staff who have been on duty during the previous 24 hours discuss the patients admitted for care), ward rounds, and case presentations alongside continued supervision of the latest new admissions.

2. Weekly distance-learning, interactive, international tutorials were provided for all 3 trainee groups using Zoom meetings by 4 experts in obstetrics (Dr Brigid Hayden, Dr Kim Hinshaw, Dr Maire Casement and Prof David Southall), 4 experts in neonatal care (Dr Alison Earley, Dr Barbara Phillips, Prof Neil McIntosh, Dr Ann Duffy) and 4 experts in paediatric hospital care (Dr Sarah Band, Prof David Southall, Dr Alistair Morris, Dr Alison Earley). During some of these sessions, clinical case presentations and clinical audit were discussed in detail. Links to the content of these weekly trainings specific to obstetrics, neonatal and paediatric care year 1 and year 2 are available for view here.

3. Each trainee was given a computer tablet or laptop computer containing an extensive E-library of relevant publications and videos pertinent to low resource settings for training purposes and for the 3 specific groups; obstetrics, neonatal and paediatric care.

4. Each trainee was also provided with an electronic and hard copy of MCAI's comprehensive handbooks on hospital care in low resource settings in maternal, paediatric, and neonatal health care.

Handbook 1 addresses advanced hospital care for pregnant women and adolescent girls and is used for the training of obstetric clinicians.

Handbook 2 addresses advanced hospital care for newborn infants and is used for the training of neonatal clinicians.

Handbooks 3 and Handbook 4 address the care of infants, children, and adolescents with serious illnesses and injuries. They form part of the curriculum for the training of the first ever 12 paediatric clinicians in Liberia.

PDFs of all 4 handbooks are updated every 1-2 years and are available for download from MCAI's website by clicking on the links above.

A total of 1,000 handbooks (250 of each of the above 4) have also been printed and distributed to nurses, midwives, and doctors throughout Liberia (from a grant from Irish Aid).

Continuous assessment
All trainees were continuously assessed to ensure that they were competent, knowledgeable, and safe.

After completion of each foundation course, each trainee would need to pass an annual Objective Structured Clinical Examinations (OSCEs).

During the apprenticeship training, each trainee undertook weekly written tests (produced by international experts with experience in low resource settings) and marked by the same international expert doctors (see earlier for details) on the topics on which they were taught the week before. The results of each test are fed-back to the trainees through international audio-visual conferencing and provide continuous evaluation while highlighting any areas where further training is needed.

Before graduating as qualified clinicians, the trainees must pass oral and written examinations marked by international experts from MCAI national trainers and accompanied, when possible, by written evaluations from their national trainers.

Monitoring and Evaluation
The progress of each individual trainee is monitored by the recording of each procedure that they have performed and their outcomes during their training in both a paper and electronic logbook. Please see the logbooks for each set of trainees below and, on-line, an **anonymized** example of a completed logbook by one of the obstetric clinicians.

The results of their weekly written exams, OSCEs, and high-level written exams are also recorded (see below for specific examples)

Monitoring of maternal, neonatal, and paediatric mortality rates in the catchment areas of the hospitals in which the training is being undertaken are described in the specialty sections below.

Plans were prepared to institutionalise all three specialities of the National Task Sharing Programme within a Liberian University. With additional support from the University of Edinburgh, this approach aimed to provide an accredited BSc degree for all graduates of the task-sharing programs.

1 Training of Obstetric Clinicians
Summary of training (note overlapping training times.
September 2013 to October 2016 First 2 trained (2 midwives). Both qualified
November 2015 to January 2019 Second set of 9 trained (7 midwives, 2 Physician Associates PA). 8 qualified (1 PA failed final assessments and examinations)
February 2018 to February 2021 Third set of 10 trained (all midwives) 9 qualified and 1 successfully qualified 9 months later after examination and assessments.
May 2020 to October 2023 Fourth set of 9 trained (all midwives) 9 qualified.
TOTAL: 30 trained. One sadly died and 1 failed examinations and assessments. 28 now working.

The first two trainee obstetric clinicians (Ms. Hannah Gibson and Ms. Naomi Lewis) began their training at CB Dunbar Hospital in October 2013. The Partnership viewed this initial phase of the project as the pilot period, to test the feasibility of the program under the supervision of Dr Obed Dolo, Consultant Obstetrician Liberia. Expert international doctors from Europe provided further support for the beginning of the apprenticeship training.

The Ebola outbreak disrupted the supportive training from international experts, but Hannah and Naomi continued to work throughout the Ebola outbreak, providing much needed support to Dr. Dolo and his team.

ABOVE: Outside CB Dunbar Maternity Hospital in Bong County, during the Ebola outbreak. Standing just outside a cordon protecting visitors from entering the hospital until they have washed their hands in chlorinated water and had their temperatures taken are from left to right Jeremiah Akoi (MCAI logistician), Naomi Lewis, Hannah Gibson (first two trainee obstetric clinicians). On the right is Dr. Dolo, master-trainer, consultant obstetrician and the Director of the Hospital.

Both Hannah and Naomi successfully passed their end of second year OSCE with high marks (81%and 76%) and in October 2016, these first two trainee obstetric clinicians finally qualified and eventually were registered by the Liberian Medical and Dental Council (LMDC). During this period, they worked at 3 additional hospitals (Phebe, CH Rennie, and Redemption) and in addition to their continued learning, they assisted in the training of junior doctors and participated in the management of all activities within the maternity unit. Their work, particularly overnight, helped to provide better sleep patterns for the doctors they worked with and generally created an efficient working environment that made all involved proud of what they were achieving.

Since the start of the apprenticeship part of their training in October 2013 until March 2015, both trainees helped perform perform 353 advanced obstetric procedures, including 236 Caesarean sections. They also helped manage 41 patients with eclampsia or severe pre-eclampsia, 25 with post partum haemorrhage and 21 with shock. (see Bulletin WHO 2016). Following completion of their final examinations in October 2016, they were contracted to work as licensed obstetric clinicians in public hospitals chosen by the MOH and for a minimum of 5 years. Representatives from the Partnership attended their graduation ceremony in July 2017 (See picture below).

Because of the encouraging results of the pilot phase, in 2015, and following a review by WHO funded by Irish Aid, the Partnership agreed to scale up and roll out the program and recruited a further 9 trainee obstetric clinicians who began their training in November 2015. Seven of the trainees were midwives (Mrs. Oretha Buway; Ms. Saneh Kollie; Mrs. Lucretia Kokoi; Mr. Emmanuel Hne; Ms. Jackie Sudue; Ms. Korpu Borzie; and Ms. Ariza Jolo) and 2 were physician assistants with prior extensive experience in hospital-based midwifery (Mr. Jonathan Lobbo and Mr. William Korboi). Four of the nine trainees were originally working in Martha Tubman Memorial Hospital, a rural and very difficult to reach hospital in Grand Gedeh county..

Dr. Dolo and Professor Southall continued to oversee the training. In CB Dunbar Hospital, apprenticeship-based training was led by Dr Dolo, in Redemption hospital by Dr. Nowiah Gorpudolo and in CH Rennie hospital by Dr. Kumblytee Johnson and Dr. Magnus Asinya. Two obstetricians from the UK (Dr. Maire Casement and Dr. Camille

Lallemant) visited for long periods to further support their training. Professor Southall lead on the weekly tutorials with support from Dr. Casement, a consultant obstetrician from Northern Ireland, Dr Hayden and Dr Hinshaw UK consultant obstetricians from England and Dr. Diane Watson, a consultant obstetric anaesthetist from Wales.

By February 2017, all trainees had passed their end of 2nd year OSCE and all performed well in their weekly exams. They began their internship in 4 rural hospitals: Martha Tubman Memorial in Grand Gedeh County, Fishtown Hospital in River Gee County, CH Rennie Hospital in Margibi County and Tellewoyan Hospital in Lofa County. Here they worked for one year in partnership with local doctors to care for pregnant patients. They also worked closely with community midwives to enhance the integration necessary to reduce delays in recognising, treating, and referring patients. During internship, bimonthly audits were undertaken by internet using audio-visual links from an I-pad concerning cases of serious maternal emergencies encountered during the work of the 3 groups of 9 trainees in the three rural hospitals in which they are based. These audio-visual audits were undertaken by Dr. Dolo from C.B. Dunbar Hospital and by the UK experts, Professor Southall, Dr. Casement, and Dr. Watson.

In January 2019, a final examination both written and oral was undertaken but only the 8 of the 9 trainees were identified as fully competent in the medical and surgical management of critically ill patients, including Caesarean section and abdominal operations for situations where there is catastrophic haemorrhage and obstructed delivery as well as the emergency treatment of fitting (eclampsia), of life-threatening infection, of fetal distress requiring urgent intervention and several other dangerous problems during pregnancy and delivery.

Above: Team from Tellewoyan County Hospital in Lofa County including Medical and County Health Directors, Nursing Director and Dr. Rosette Namulindwa, a consultant obstetrician from Uganda funded by UNFPA.

Dr Dolo being welcomed by the Medical Director, Dr Detoh Toe King, to Fishtown Hospital in RiverGee County, one of the hospitals where internship occurred.

Despite additional training 1 of the 9 continued to fail the final assessment. Therefore only 8 of this group of 9 trainees were successfully registered with the LMDC

From the start of training in October 2013 to the beginning of November 2017 a **total of 1,654 Caesarean sections were undertaken by the first 11 trainee obstetric clinicians.**

Because of the success of the program, in November 2017, the Partnership began to recruit and eventually appointed in January 2018, ten further trainees (out of 26 candidates), specifically selected from the most rural areas of Liberia. These 10 trainees started the training program in February 2018 and followed the same training plan as the previous trainees, and becoming successfully qualified in February 2021.

By March 2024, 27 senior midwives and 1 physician assistant have become fully qualified after 3 years of training (one tragically died RIP). Thus 28 experienced midwives (obstetric clinicians) have successfully completed 3 years training in advanced obstetric care, including major surgery such as Caesarean Section, and vacuum delivery and are currently working in 7 hospitals and 2 CEmONC health centres.

Overall, apprenticeship type training has been supervised on a 24/7 basis by 7 Liberian consultant obstetricians in Redemption, CH Rennie and CB Dunbar Hospitals (Dr Obed Dolo, Dr Gorpudolo-Dennis, Dr K Johnson, Dr V.King, Dr Goya, Dr Massaley, and Dr Harris) supported by regular in country visits by experts in obstetrics (Dr Maire Casement, Professor David Southall, Dr Alice Clack, Dr Johan Creemers, and Dr Camille Lallemant).
As the obstetric program developed, qualified obstetric clinicians Mrs K Borzoi, Jefferson Doe, Noah Jasper, Emmanuel Hne, Ariza Jolo and Mrs N Wameh provided major apprenticeship training support (and also assisted in training junior Liberian doctors in advanced obstetrics).

Please click here for the initial Foundation course focused on the basics of advanced obstetric care, including basic surgical skills, obstetric anatomy, obstetric ultrasound, and post-operative care.

The subsequent apprenticeship involved the performance of essential obstetric procedures and management of major complications of pregnancy and delivery under the supervision of the trainers. Trainees gradually progressed from assisting with procedures and emergency management, through to direct and indirect supervision, and finally, being able to perform the procedures, including undertaking Caesarean Sections, independently.

Later in the obstetric clinician training program, Dr Obed Dolo (a national and international expert) provided apprenticeship-based training in obstetric ultrasound scanning at Redemption Hospital for the latest group of 9 trainees.

Once qualified after 3 years of apprenticeship-based training, these midwives are called obstetric clinicians and have received advanced skills in managing medical conditions during pregnancy, pregnancy specific conditions, practical and surgical obstetrics, and advanced obstetric ultrasound scanning.

Weekly tutorials from international experts in obstetrics continued via Zoom before, during, and since the Covid pandemic.

On completion of the programme the Obstetric Clinicians work in the rural districts providing:
1.Acute intrapartum care with medical and surgical skills in emergency obstetrics
2. Antenatal ultrasound scanning as part of an advanced obstetric outreach programme (see later in this report)

Throughout and when possible MCAI has provided equipment, emergency drugs, and supplies to help enable safe healthcare despite a Government Stockout of essential drugs and supplies throughout the last 4 years.

MCAI has developed a specific clinical audit form that trainees have to complete if they have been involved in managing a maternal death. National and international trainers review these forms on a regular basis with the trainee involved and discuss any pertinent issues.

Every trainee obstetric clinician undertakes a weekly examination covering subjects taught by international experts in the preceding week. (see links containing details of the weekly training for the last cohort of 9 obstetric clinicians and also linked here one of the weekly examinations).

Annually there were written and OSCE (practical) examinations which each trainee must pass in order to continue the training.

At the end of the 3 years a final examination is undertaken (see results below from the latest group of obstetric clinicians who have qualified). An evaluation form on each trainee was undertaken by the Liberian consultant obstetrician who supervised the apprenticeship part of their training.

Experiences of trainee obstetric clinicians (including some case histories)

Korpo Borzoi Trainee obstetric clinician (see picture on the right)

"As an obstetric clinician I have learned a lot. From this training I'm able to attend to obstetric emergency promptly, timely, confidently and with no fear while calling or waiting for a doctor's help. I can also manage and or supervise the labour ward properly because we are also trained as a manager and supervisor. And most of all I'm able to do a caesarean section. This training has also helped to build my confidence and most of all my self-esteem. One of my challenges during the course of training happened about a year ago with a patient who was transferred for obstructed labour and my senior doctor had just left to find food to eat. So, he asked me to do the caesarean section along with the intern Doctor. During the surgery, the patient had a deep posterior tear in the uterus which was repaired without senior doctor help. It was difficult but it was done. I monitored the patient, especially the vital signs the whole night worrying about bleeding, but she did not bleed. She was discharged 8 days later along with her baby. We kept the urinary catheter in for seven days to prevent a fistula forming because of the original obstructed labour. "

Naomi N. Lewis qualified obstetric clinician (see picture below)

"One of my greatest experiences has to do with a patient who had a home delivery and was rushed on the labour ward because she was bleeding, and at this time I was in my second year in training. On arrival, my MD was in surgery, and I was left on the ward with the midwives. Guess what happens! The midwives were all terrified because of the excessive bleeding. I quickly informed my MD who was in surgery, and he ask me to start with some management until he could arrive. These were the managements. Established intravenous lines, resuscitated with normal saline 1000ml to help shock, put on an anti- shock garment, ordered lab tests, and requested for 3 units of blood for transfusion. We continued monitoring vital signs and tried to find out the cause (s) for the bleeding. I found that our patient had bilateral tears in her cervix, and these were repaired by me and our patient was stabilized.

I firstly thank God for the opportunity given me through MCAI, MOH, and our trainers especially Dr. Dolo to improve my professional life and taking me to another higher level of work. I am grateful that other women can benefit from my achievement today. May our God who gave the training to me bless you all".

Ariza Jolo Qualified obstetric clinician.
A 25-year-old pregnant woman spent 24 hours in obstructed labour at a clinic a long way from the county hospital before finally arriving for treatment. On presentation, she was shocked and severely anaemic with an enlarged tender abdomen. An ultrasound scan confirmed rupture of the uterus and fetal death.

As the obstetric clinician on call, I was the only person in the hospital with the skills needed to treat this patient.

The patient was treated for shock, given 4 units of fresh blood for transfusion obtained from relatives, and the obstetric clinician operated and successfully repaired major anterior and posterior ruptures of the uterus. The patient eventually fully recovered and was discharged home.

Ariza Jolo undertaking obstetric outreach work including ultrasound scanning (see later in this report).

Above: Hannah Gibson RIP (one of the two first qualified obstetric clinicians) leading a Caesarean section.

Above: Two obstetric clinicians undertaking an emergency Caesarean section at Redemption Hospital (one of the two training hospitals for obstetric clinicians) in Liberia.

Monitoring and evaluation

Please see below an overview of the analysis of data of emergency obstetric procedures made available to MCAI. The Table below is an overview and the full report is available for link here. These data were obtained from the theatre records book only and individual cases have not been further investigated for the scope of our monitoring and evaluation. The purpose of the data is to give an overview of the emergency obstetric procedures performed along with maternal and fetal outcomes. We have focused only on the lead surgeon for the procedure and have separated the team into qualification route to demonstrate impact of the task-sharing programme. Please note – there is no general surgical or gynaecological procedures included in this data.

Maternal emergency hospital care in 6 CEmONC facilities 2021-2022

Hospital	2021 Total surgical procedures	**2021** Total CS	Number lead surgery by doctor	Number lead surgery by Obstetric Clinician		**2022** Total surgical procedures	2022 Total CS	Number lead surgery by doctor	Number lead surgery by Obstetric Clinician
CB Dunbar	514	488	203	311		649	597	212*	430
Saclapea MHC	189	169	10	179		132	115	15	116
MTMH	240	237	150	90		241	225	89	146
Sinje MHC	89	84	14	75		68	66	20	48
FJ Grant	92	85	69	23		77	75	63	14
Fishtown	104	95	65	32		127	125	62	65
Totals	**1,228**	**1,158**	**511(42%)**	**710 (58%)**		**1294**	**1203**	**461 (36%)**	**819 (63%)**

**7 operations no definite details of doctor involved.*

Once qualified, the obstetric clinicians participate in obstetric outreach- see report in Appendix 1 at the end of this report.

Intravenous paracetamol for managing pain in labour.
Following experience with the fetal monitoring by mothers during labour, it was clear that there is almost no analgesia provided during labour in public hospitals in Liberia creating extreme pain for many mothers and interfering with monitoring for fetal distress (please see Part 2).

After research into the use of intravenous paracetamol in other countries had shown minimal side effects, and after permission from the lead Liberian pharmacist and the request of the MOH, a pilot of the use of this drug was undertaken according to a strict protocol. The results were exceptionally favourable and please click here to see them. Unfortunately, the MOH did not give permission for the pilot to be rolled out to other hospitals for reasons unknown. MCAI strongly recommends that IV paracetamol is made available to women in labour throughout Liberia.

BELOW:: Two neonatal clinicians helping the mother of triplets. MCAI paid for her to have some food when she was discharged so she could continue breast feeding.

ABOVE:Obstetric clinician Ariza Jolo operated on the mum of twins, a boy and girl who did very well.

Results of final examination for latest group of 9 obstetric clinicians September 2023

		Names									Totals
	Summary of question	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Exam Session 1											
Q1	Obstetric outreach (excluded as ambiguous)										
Q2	Complication Caesarean section										30
Q3	Vaginal breech delivery										80
Q4	Contradiction to vaginal breech delivery										30
Q5	Head trapped during breech delivery										40
Q6	Dating pregnancy duration										5
Q7	Signs of different pregnancy duration										10
Q8	Infections during pregnancy										15
Q9	Severe anaemia during pregnancy										20
Q10	Management ruptured ectopic pregnancy										60
Q11	Heart failure due to severe anaemia										60
Q12	Treatment severe anaemia										10
Q13	Pelvic anatomy picture										20
Exam Session 2											
Q1	Shoulder dystocia										100
Q2	Delivery of second twin in transverse position										100
Q3	Anatomy pelvis to avoid blood vessels/ ureter										20
Q4	Dangers during MVA										20
Q5	Ruptured ectopic is there time for transfer?										20
Q6	Management inevitable septic miscarriage										50
Exam Session 3											
Q1	Neonatal resuscitation										60
Q2	Stretching cervix and sweep membranes										25
Q3	Indications for induction of labour										20
Q4	Artificial rupture of membranes where IUFD										30
Q5	Indications for oxytocin infusion										20
Q6	Dangers of oxytocin infusion										30
Q7	Management of shock after Caesarean section										40
Q8	Destructive procedure										30
Exam Session 4											
Q1	Symptoms and signs placental abruption										30
Q2	Symptoms and signs placenta praevia										30
Q3	Antepartum haemorrhage with shock										60
Q4	Concealed post-partum haemorrhage										30
Q5	Management of massive post-partum haemorrhage										60
Q6	Management large cervical tear										30
Q7	Post-partum haemorrhage with severe infection										60
Exam Session 5											
Q1	Retained placenta management										30
Q2	Investigations and actions before Caesarean section										30
Q3	Management severe preeclampsia										40
Q4	Management eclampsia										40
Q5	Risk factors for ruptured uterus										20
Q6	Blood group safe practice										10
Q7	Management obstructed labour and IUFD										40
Q8	Management chorioamnionitis										30
Q9	Reasons for vacuum delivery										20
Q10	Conditions prior to safe vacuum delivery										40
Q11	Suturing the uterus during Caesarean section										20
											1565
Results Examiners											4695
	Dr. Máire Casement	1323.0	1288.0	1342.0	1233.5	1219.0	1165.0	1271.0	1228.5	1259.5	
	Dr. Brigid Hayden	1444.0	1365.0	1397.0	1403.0	1438.0	1362.0	1403.0	1367.0	1400.0	
	Prof. David Southall	1428.0	1350.0	1394.5	1403.0	1400.5	1327.0	1373.0	1339.5	1387.0	
Totals		4195.0	4003.0	4133.5	4039.5	4057.5	3854.0	4047.0	3935.0	4046.5	
Percent		89.4	85.3	88.0	86.0	86.4	82.1	86.2	83.8	86.2	
Designation		Distinction	Merit	Distinction	Distinction	Distinction	Merit	Distinction	Merit	Distinction	

65 to 79% = pass
80 to 85% = a pass with merit
86% or more = a pass with distinction

Those subjects outlined in pink needed some additional refresher trainings which were completed in February 2024

2. Training of Neonatal clinicians

17 experienced nurses (neonatal clinicians) have completed three 2-year courses of training in advanced hospital neonatal intensive care (including nasal CPAP but not assisted ventilation following intubation) and are currently leading care in 7 neonatal units established over the last 6 years in rural Liberian public hospitals. Training is based on the same structure as the obstetric program, that is, apprenticeship training supplemented by weekly distance-learning tutorials, and an internship year. However, as no surgery is involved, the training program can be completed in two years.

Course 1: 4 fully qualified after 2 years of training (1 additional nurse qualified but left the program after 6 months for a placement in the USA)

Course 2: 5 completed training and qualified in January 2021. (1 had part way through left the program for the Netherlands to undertake an international MPH course against advice but supported by MOH)

Course 3: 8 new trainees qualified September 2022 (4 with distinction)

Trainers:

Apprenticeship training was supervised by a full time international advanced neonatal nurse practitioner (Adeyemo Kola from MSF Nigeria) and a Liberian consultant paediatrician (Dr Minnie Ricks) supported by regular in-country visits by Professor Neil McIntosh, and Alysia Humphrey from the UK, and Dr Jean Junior, a pediatrician from the USA and Professor David Southall). Internet based training was provided by 5 MCAI volunteers*:* Dr A. Earley, Dr A Duthie, Prof N. McIntosh, Dr Barbara Phillips, Prof D Southall.

As with obstetric clinician training:

- weekly tutorials (via Zoom) by international volunteer experts in neonatal care from the UK.
- written weekly examinations constructed and marked by international experts in neonatal care in low resource settings.
- An evidence-based, up-to-date handbook on advanced neonatal care suitable for low resource countries published by MCAI.

The training program followed a curriculum developed by MCAI and approved by all partners. It covers neonatal resuscitation and managing major complications seen in the neonatal period such as overwhelming infection (sepsis), breathing problems (asphyxia) and brain injury due to lack of oxygen and impaired circulation to the fetus during pregnancy and delivery.

As with the obstetric training, the neonatal trainees are involved in handover meetings, ward rounds, and case presentations.

Monitoring and Evaluation

The monitoring and evaluation of the neonatal clinician training program follows the same requirements as the obstetric program: each trainee must record all performed procedures and the outcome in a paper and electronic logbook (see Figure below); weekly exam results are recorded, and monitoring of neonatal mortality rates in the catchment area of CB Dunbar Hospital is undertaken jointly by MCAI the MOH, and WHO Liberia.

On completion of the programme the Neonatal Clinicians work in the rural districts providing:

- Neonatal Resuscitation
- Advanced Neonatal Care in dedicated neonatal units (MCAI has developed 9 neonatal high dependency intensive care units with equipment, emergency drugs and supplies to enable safe healthcare).

- Initially the emergency drugs and supplies provided by MCAI supplemented those provided by the Ministry of Health. However, over the last 4 years minimal quantities have been provided by the MOH, most was provided by families who were required to purchase the drugs and supplies from local pharmacies before emergency treatment could be given resulting in major life-threatening delays in emergency care. MCAI, with support from UNICEF and Irish Aid, supplemented emergency drugs, when possible, but often the amounts needed were insufficiently available with resulting dangerous delays in effective management.

ABOVE: *Neonate receiving nasal continuous positive airway pressure (CPAP) for respiratory support*

BELOW: *First 4 trainee neonatal clinicians along with advanced neonatal nurse practitioner Kola Adeyemo, their master trainer.From left to right: Clement Z. Whenda, Christina W Nyenabo, Gertrude Y Makor Agnes M. Smith and Kola Adeyemo*

BELOW: *The team of 4 trainee neonatal clinicians with International Volunteer from the University Hospital of Southern California (Dr. Jean Junior) and Dr. Dolo in the office of the newly renovated neonatal intensive care unit at CB Dunbar Hospital.*

BELOW: *Neonatal clinician trainees with Professor Neil McIntosh, Retired Professor of Neonatal Medicine from Edinburgh University, who worked closely with them for long periods in Liberia*

Clinical experience of the trainee neonatal clinicians. Baby named "Success" and his story

Success was delivered by Caesarean section at CB Dunbar Hospital at 28weeks gestation weighing 1.25 Kg. His mother suffered prolonged eclampsia (fitting) with persistent coma and tragically died soon after Success was born. Success was resuscitated for 3 minutes with bag and mask assisted ventilation and later started to breath spontaneously and taken to the NICU.

Success was placed inside the incubator for warmth and on nasal CPAP to help with his breathing and keep the lungs open. He was also started on intravenous fluids and antibiotics. On the second day of life, he started responding well and was weaned off CPAP to continue with additional inspired oxygen. Due to the death of his mother, no breast milk was available and so he was started on Formula feeding. At present there is no breast milk bank available in Liberia, although this is planned.

His relatives were taught how to undertake skin to skin care (KMC) which they complied with. The baby's father later moved into the hospital to continue with the provision of KMC and it was amazing for other mothers in the NICU to see a man taking up this challenge. Doctor Jean Junior also participated in the KMC challenge!
Success's care and treatment continued for more than a month in the NICU before he was later discharged home having reached a weight of 2kg. Relatives were counselled on the need to return to the hospital for follow up care. At his last visit he weighed 2.8kg and was doing well with relatives helping to continue his care.

BELOW: *Baby Success in an incubator in NICU with his father and with Dr Jean Junior, international volunteer*

BELOW: *Success with international volunteer Alysia Humphrey when he returned to NICU for follow up*

BELOW: *The trainee neonatal clinicians and nurses with Baby Success and his father when he was discharged from the NICU. In the forefront is master trainer Nurse Adeyemo Kola.*

With much help from his father and the neonatal team, this baby went home.

ABOVE: Baby Success reviewed two months after discharge

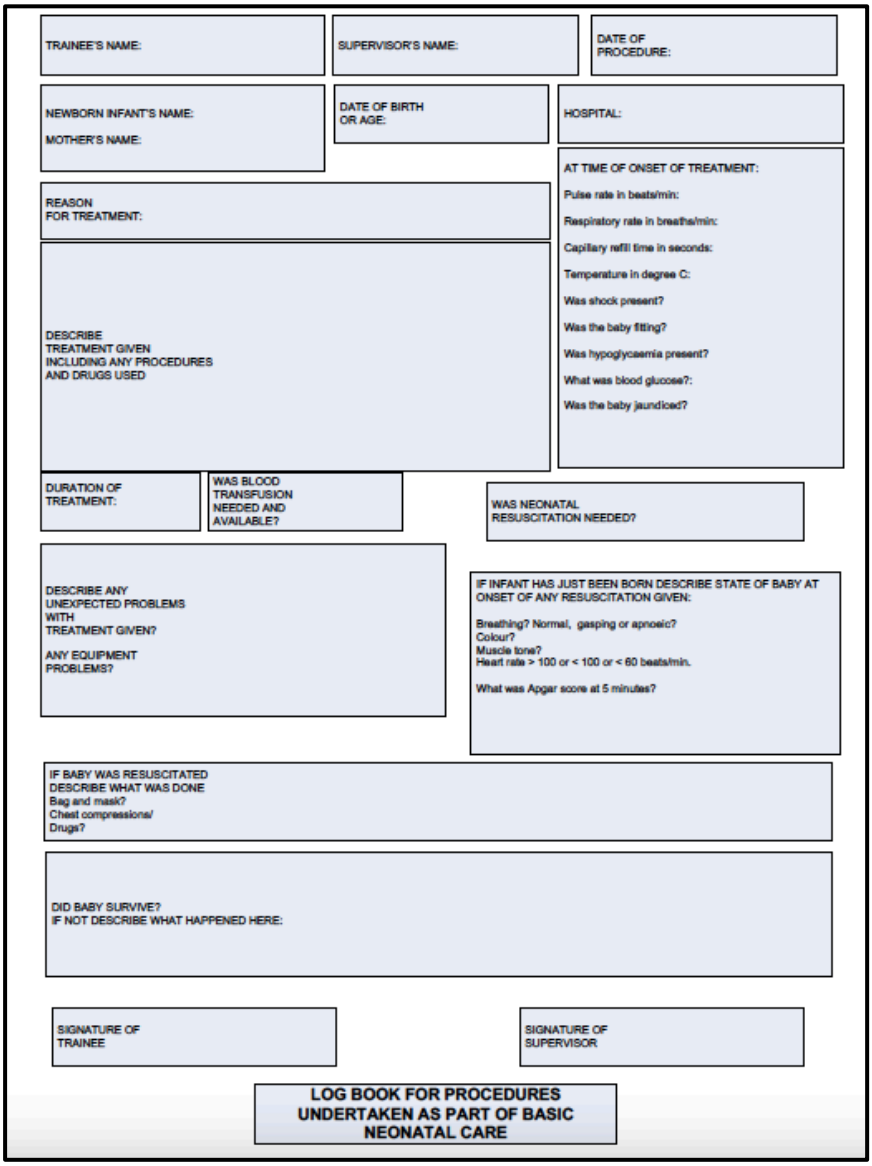
ABOVE: *Latest group of qualified neonatal clinicians outside the CB Dunbar neonatal training wards*

First developed neonatal unit at CB Dunbar Hospital, Bong County which became the main training facility.

Please click here for the curriculum for neonatal clinician training.

Please click here for a weekly document describing the neonatal training program

Logbook for neonatal clinician training


TRAINEE'S NAME:

SUPERVISOR'S NAME:

DATE OF PROCEDURE:

NEWBORN INFANT'S NAME:

MOTHER'S NAME:

DATE OF BIRTH OR AGE:

HOSPITAL:

AT TIME OF ONSET OF TREATMENT:

Pulse rate in beats/min:

Respiratory rate in breaths/min:

Capillary refill time in seconds:

Temperature in degree C:

Was shock present?

Was the baby fitting?

Was hypoglycaemia present?

What was blood glucose?:

Was the baby jaundiced?

REASON FOR TREATMENT:

DESCRIBE TREATMENT GIVEN INCLUDING ANY PROCEDURES AND DRUGS USED

DURATION OF TREATMENT:

WAS BLOOD TRANSFUSION NEEDED AND AVAILABLE?

WAS NEONATAL RESUSCITATION NEEDED?

DESCRIBE ANY UNEXPECTED PROBLEMS WITH TREATMENT GIVEN?

ANY EQUIPMENT PROBLEMS?

IF INFANT HAS JUST BEEN BORN DESCRIBE STATE OF BABY AT ONSET OF ANY RESUSCITATION GIVEN:

Breathing? Normal, gasping or apnoeic?
Colour?
Muscle tone?
Heart rate > 100 or < 100 or < 60 beats/min.

What was Apgar score at 5 minutes?

IF BABY WAS RESUSCITATED DESCRIBE WHAT WAS DONE
Bag and mask?
Chest compressions/
Drugs?

DID BABY SURVIVE?
IF NOT DESCRIBE WHAT HAPPENED HERE:

SIGNATURE OF TRAINEE

SIGNATURE OF SUPERVISOR

LOG BOOK FOR PROCEDURES UNDERTAKEN AS PART OF BASIC NEONATAL CARE

Neonatal clinician handbooks (click here for PDF***)***
Printed copies of the published neonatal care handbook have been distributed to:

1.Doctors and nurses working in 25 public hospitals throughout Liberia (in all 15 counties) who are caring for newborn infants, children, and adolescents; including girls who are pregnant
2. Final year medical students
3. 18 accredited nursing and midwifery schools.

Structural development to provide public rural hospital departments for neonatal intensive care.
7 neonatal intensive care units have been completed.

- CB Dunbar Hospital, Bong (Funded by MCAI and UNFPA)
- CH Rennie Hospital, Margibi (Funded by UNFPA)
- Martha Tubman Hospital + *extension completed in Grand* Gedeh County (UNICEF and MCAI funded the equipment and MCAI funded the initial renovation and the new extension)
- Phebe Hospital, Bong (renovated and equipped by MCAI with Irish Aid Funding)
- Tellewoyan county hospital, Lofa (renovated and equipped by MCAI with Irish Aid Funding)

- Sinje major health centre, Grand Capemount (Original building UNFPA, Renovation funded by MCAI and equipment funded by UNFPA procured by MCAI from UK). Subsequently UNICEF provided funds for this development.
- FJ Grant Hospital in Sinoe. Equipment was funded by MCAI and renovation by the DAK Foundation in Australia.

Two new units are now under development (including equipment) provided by a grant from Irish Aid

- Fishtown Hospital in Rivergee County.
- The new Hospital in Rivercess County

CB Dunbar Neonatal Unit

This unit was the base for neonatal clinician task-sharing training, led in the first 6 years by Advanced nurse practitioner Adeyemo Abbas Kola with support from qualified neonatal clinicians (Annie Johnson and Gertrude Makor). The latest 8 trainees from the SE Region of Liberia and from Lofa have now qualified.

About 80 critically ill newborn infants are treated every month in the CB Dunbar neonatal unit.

Three low birth weight infants treated at CB Dunbar Hospital

Adeyemo Kola main trainer at CB Dunbar NICU

NICU at CH Rennie Hospital before the whole hospital was destroyed by fire in August 2021

Quadruplets at CH Rennie born before the hospital was destroyed by fire.

Here is a link providing details of the equipment provided for each new NICU.

ABOVE: Patient and her baby in NICU in Martha Tubman Memorial Hospital. The NICU constructed by MCAI in 2019 and then extended 2020 and managed and led by Christina Nyenabo and Massanjay Sheriff, Neonatal Clinicians.Equipped by UNICEF and MCAI.
Around 45 critically ill newborn infants are treated in this unit every month.

Urgent action is needed in Grand Gedeh for a NICU and CEmOC facility at Konobo health centre.

ABOVE: ***Tellewoyan*** *NICU constructed and equipped by MCAI in 2021 and initially managed and led by Mercy Paye, Neonatal Clinician, supported by Nyamah Kromah neonatal clinician intern. Now managed by qualified neonatal clinician Kolako Kolubah. Many admissions are born outside Tellewoyan Hospital and arrive in a poor condition.*

Prior to the establishment of these neonatal units, there were no NICUs in these 7 rural counties in Liberia. The major causes of morbidity and mortality in the 2 largest units at CB Dunbar Hospital and Martha Tubman Memorial Hospital are documented in the linked Tables. Please find the data from 2022 with activity from the previous year 2021 as a comparison. The data were obtained from the neonatal unit Admissions Books only and individual cases have not been further investigated. The purpose of the data is to give an overview of the demand and activity on the Neonatal Unit along with Neonatal Outcomes.

Between 2019 and by June 2022 a total of 2585 neonatal patients have been cared for with 319 deaths (12%).

Training in neonatal resuscitation

Both obstetric and neonatal clinicians have been trained to provide advanced resuscitation of the newborn infant who does not breathe at birth and are also training nurses and midwives in health clinics in rural counties where babies continue to be born (see information below). Qualified neonatal clinicians have also provided neonatal resuscitation training to skilled birth attendants in Grand Gedeh and Sinoe Counties as part of an Irish Aid Grant. (see Appendix 2 at the end of this report)

The final examination results from September 2022 for the latest 8 qualified neonatal clinicians are given below.

Trainee	Examiner	Paper 1 325	Paper 2 375	Paper 3 365	Total 1065	Percent %	Overall Average % 2130
Name Rivercess	DS AE	295 91% 295 91%	318.5 85% 295 79%	292.5 80% 297.5 82%	906 887.5	85 83	1793.5 84% Merit
Name Sinoe	DS AE	305 94% 315. 97%	312.5 83% 295 79%	310 85% 315. 86%	927.5 925	87 87	1852.5 87% Distinction
Name River Gee	DS AE	315 97% 310 95%	315 84% 310 83%	342.5 94% 330 90%	972.5 950	91 89	1922.5 90% Distinction
Name Lofa	DS AE	307.5 95% 290 89%	335 89% 325. 87%	325 89% 327.5 90%	967.5 942.5	91 88	1910 90% Distinction
Name Grand Gedeh	DS AE	307.5 95% 315 97%	327.5 87% 312.5. 83%	327.5 90% 335 92%	962.5 962.5	90 90	1925 90% Distinction
Name Sinoe	DS AE	287.5 89% 300 92%	307.5 82% 290 77%	282.5 77% 290 79%	877.5 880	82 83	1757.5 83% Merit
Name Lofa	DS AE	260 80% 282.5 87%	232.5 63% 215 57%	277.5 76% 290 79%	770 787.5	72 74	1557.5 73% Pass
Name Konobo, Grand Gedeh	DS AE	315 97% 300. 92%	305 81% 292.5 78%	280 77% 285 78%	900 877.5	85 82	1777.5 83% Merit

Final examination results for the latest 8 neonatal clinician trainees September 2022

AE = Dr Alison Earley DS = Professor David Southall. Distinction >84%; Merit 80 to 84%; Pass 70 to 79%

3. Paediatric clinician training

An Overview of Paediatric Mortality in 4 Rural Hospitals in Liberia (FJ Grant, Fishtown, MTMH and Phebe) (Data prepared by Dr Sarah Band* and Hassan Abdulkadir)
*MCAI Honorary Paediatric Clinician Training Programme Lead

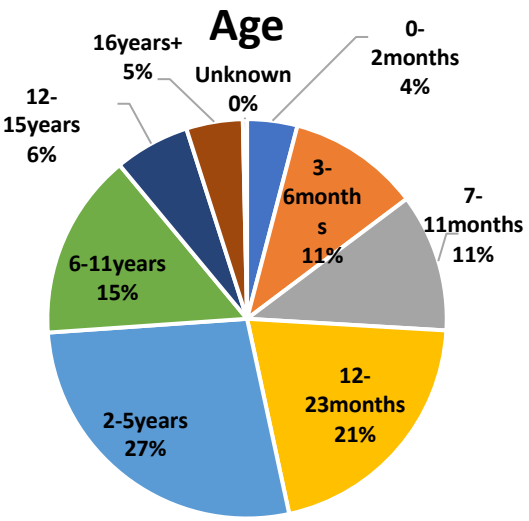
To assess the need for Paediatric Clinicians in the rural hospitals we collected paediatric mortality data from four rural hospitals in Liberia. The themes highlighted from the results will help to improve the care of paediatric patients across the country as well as guide key points for education and teaching.

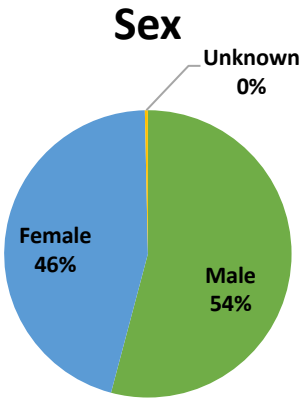
This data was collected from 2 sources, the first was the admissions book where patients and their outcome are documented on the ward. The second was the individual patient notes. There are some discrepancies between the two sources when it comes to numbers of death – we have therefore used the higher number of deaths to ensure we capture all cases of paediatric mortality. The data was collected from 2018-2021 (in one facility the data was collected until July 2021).

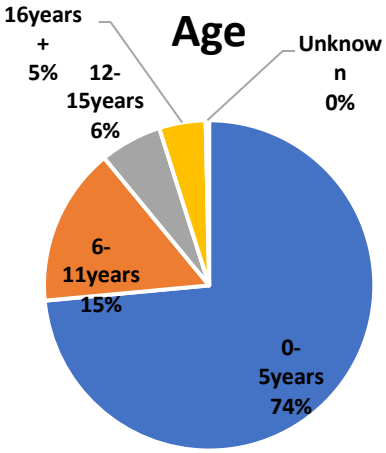
Data from admissions book:
(Please note there was one hospital with no admissions book data presented)
Admissions: 7217
Deaths: 321
This gives us a **mortality rate of 4.4%** in patients admitted to hospital.

Data from patients' case notes:
Deaths: 593
Cases classed as dead before/on arrival: 49 (8% of all deaths recorded)
Deaths excluding dead before/on arrival: 544
As we could not use admissions data from one of our hospitals in the data analysis we can only use the three remaining hospitals to provide a mortality rate using the case notes. In this case:
Deaths: 542
Cases classed as dead before/on arrival: 49
Deaths excluding dead before/on arrival = 493
This gives us a **total mortality rate of 7.5%.** If we exclude cases classed as dead before/on arrival the **mortality rate is 6.8%.**

In order to learn from the data we need to know more about the children who died. Please see below the sex and age of the patients.



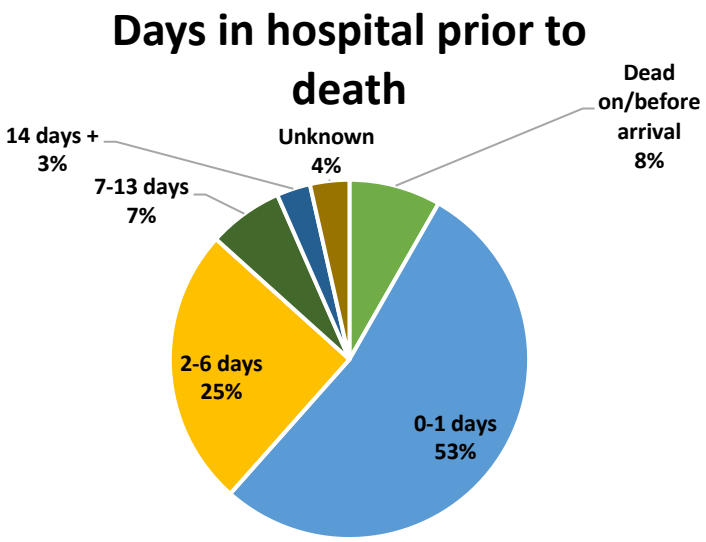




These charts demonstrate that there is no significant difference between the sex of the patients. When looking at the age of the patients we can see that 74% (436/593) of these deaths occur in the patients who are 5 years and under. The second pie chart gives us a clearer view of the age categories. The Sustainable Development Goals (SDGs) target 3.2 relates to neonatal and child mortality. It states that by 2030 we need to "aim to end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality and under-5 mortality'[2]. These data therefore confirm that we need to provide a focus on reducing the under-5 mortality rate.

We also looked at how many days the patients were in hospital prior to their death. This focus can suggest where to target our improvement strategies. For example, early deaths may suggest late presentations to hospital in which case community education and is important. They could also suggest that we need to strengthen our paediatric emergency care through training and education of health care professionals in the facilities. Late deaths may indicate the complexity and severity of the case or the need for training on inpatient

treatment in paediatrics. It is not possible to derive direct causes from the data available, but it can help with prioritisation of strategies.



The pie chart shows that 53% of patients who died were in hospital between 0-1 day, this finding suggests focusing on emergency paediatric assessment and treatment is important. In addition, we can also see that 8% of patients were classed as dying on or before arrival. In the future we need to investigate this category of patients to explore reasons for their death to provide appropriate community support, education, and prevention.

Analysing data obtained from case notes also allowed us to document the commonest presenting conditions in the patients who died. This approach helps us to prioritise strategies to reduce childhood mortality.

The conditions included:

- Malaria (alone or in combination with other conditions/co-morbidities, for example anaemia which was a very common pathology)
- Pneumonia
- Gastroenteritis, dehydration, and shock
- Sepsis and infections (alone or in combination with malaria)
- Nephrotic syndrome
- Severe acute malnutrition (presenting alone or in combination with infection)

As well as the most frequent conditions associated with death, we can also highlight key themes regarding the management of patients. With the data available individual cases cannot be commented on but important learning points can be derived from the overall trends. Please see below the key themes with notes providing more explanation.

These themes include:

- Inappropriate use of
    - Diclofenac/NSAIDs – non-steroidal anti-inflammatory drugs, often used in infants and cases of dehydration where caution is advised due to increased

risk of nephrotoxicity. Diclofenac is not advised in patients less than 9 years of age.

    - Diazepam & Phenobarbitone – very frequent use of anticonvulsant medication. We are unable to comment on seizure activity from the available data. It is very important to use only in prolonged seizures and to have a bag-vale-mask system available.
    - Steroids – often used in pneumonia and occasionally malaria. The main indications for steroids in paediatric medicine are the treatment of wheeze/asthma exacerbations and nephrotic syndrome.
    - Diuretics – often used with blood transfusions as a routine even in cases who presented with shock or dehydration. Diuretics should be reserved for patients who are at risk of fluid overload, and the child must be assessed prior to dose. If given in circulatory compromise it could lead to worsening hypotension.
- Lack of antibiotic stewardship – In some cases of infection a patient's antimicrobials were not escalated from oral to intravenous antibiotics despite deterioration. We need to develop robust guidelines to lead antimicrobial use in view of developing antibiotic resistance worldwide and resource availability.
- Fluid management in SAM – patients with severe acute malnutrition require caution with regards to their fluid management or complications can arise, particularly if presenting with shock or dehydration.
- Variable fluid resuscitation in dehydration and shock – we need to provide training and review current guidelines for the management of these conditions in paediatric patients.
- Priority of treatments – many patients received vitamin supplementation and de-worming in the acute phase of illness including those in hospital <24hours. We need to look at the priority of treatment, ensuring emergency care is the priority with the provision routine treatments for health promotion prior to discharge.

From this data we can see that paediatric mortality across rural Liberia requires our focus as a priority. There are many strategies we can use to work together to achieve a reduction in childhood mortality. The key conditions and themes above deserve special attention and can be targeted through the education of health care professions in paediatric care and the development/use of paediatric specific guidelines. This data also supports the training of Paediatric Clinicians who will go on to work in the rural hospitals helping to provide and sustain paediatric services around the country.

Summary of the clinical data from Phebe hospital prior to the onset of paediatric clinician training

Prior to the commencement of the Paediatric Clinician Training Programme in Phebe Hospital, we performed a baseline data collection of paediatric mortality using the admissions book and the case notes. From January 2018 until June 2021 the total number of admissions were 4901 and mortality rate was 10% (468 deaths). Advanced Nurse Practitioner Abdulkadir Hassan was working at Phebe Hospital from August 2021 and is one of the lead trainers for the Paediatric Clinician Training Programme alongside Dr M Ricks and supported by Dr Keita. The data for this was taken from the admissions book and ANP Abdulkadir Hassan's logbook.

We can see they have achieved a fantastic 5.1% mortality rate, reducing the rate by half compared to the previous years.

87% (569 patients) were in the under 5 category which highlights the importance of having paediatric trained clinicians available as their care varies from normal adult practice.

The key diagnoses for the admissions were as follows:

- Malaria
- Anaemia
- Lower Respiratory Tract Infections
- Severe Acute Malnutrition
- Gastroenteritis/Dehydration
- Sepsis

This list highlights the ongoing main burden of illness in the paediatric population in Phebe hospital which can likely be extrapolated across Liberia. We know that they include the top five causes of paediatric mortality recognised in previous research. We can therefore tailor our curriculum for the paediatric clinician trainees to have a key emphasis on emergency care and to have a good understanding of the above conditions and their management.

Although not common diagnoses we can see that there are several cases that require consideration for child protection including burns, poisoning and sexual assault, including rape. The poisoning cases were predominantly caustic soda ingestion with some leading to oesophageal injury. Child protection and safeguarding will be something we will build on throughout the training programme and they have received introductory training in the induction.

In addition to ensuring we can provide the most effective training for the paediatric clinician trainees; it also allows us to provide targeted health education to the communities.

For future data collection, it will be interesting to know how many of these cases are ‘dead on/before arrival’ or arrive very unwell. This finding will also impact training and health education for the community which will be important in reducing the mortality rate in paediatrics.

Overview of Paediatric Admissions at Phebe Hospital August 2021-July 2022

The data for this analysis has been taken from the paediatric ward admissions book at Phebe Hospital except for August and September 2021 which was taken from ANP Abdulkadir Hassan's personal logbook due the to the admissions book not being located by the records department.

	Age at Admission									Admissions & Outcome			
	0-2m	3-6m	7-11m	12-23m	2-5y	6-11y	12-15y	16y+	Unknown	Total Admissions	Mortality	Against Medical Advice	Referred
Aug 2021	0	3	4	11	28	3	0	0	0	**49**	0	1	1
Sept 2021	2	1	5	9	22	6	1	0	0	**46**	3* (6.5%)	0	2
Oct 2021	2	3	9	14	15	10	1	1	0	**55**	2 (3.6%)	3	3
Nov 2021	5	9	3	7	12	5	0	0	0	**41**	6 (14.6%)	2	0
Dec 2021	5	5	9	6	11	2	1	0	0	**39**	4 (10.2%)	0	0
Jan 2022	4	4	6	9	17	6	2	0	0	**48**	0	4	2
Feb 2022	3	10	15	8	13	7	1	0	0	**57**	5 (8.7%)	3	1
Mar 2022	2	1	8	13	17	1	0	0	0	**42**	3 (7.1%)	0	0
April 2022	3	5	4	13	27	6	2	0	0	**60**	2 (3.3%)	1	0
May 2022	1	4	4	13	11	1	1	0	1	**36**	1 (2.8%)	0	0
June 2022	1	5	4	7	44	10	2	0	0	**73**	4 (5.6%)	1	0
July 2022	6	9	7	25	46	8	4	0	0	**105**	3 (2.9%)	0	0
Total	34	59	78	135	263	65	15	1	1	**651**	33 (5.1%)	15	9

* 1 child was dead on arrival

Diagnosis on Discharge	Total	Diagnosis on Discharge	Total
Airway Obstruction	1	Poisoning	10
Anaemia	**115**	Rape	1
Burns	10	Renal Failure	1
Candidiasis	1	**SAM**	**50**
Chronic Liver Disease	1	**Sepsis**	**26**
Diabetes Mellitus	1	Sickle Cell anaemia	7
Enteric Fever/Typhoid	6	Skin Infection	3
Failure to Thrive/Moderate Malnutrition	4	Snake Bite	1
Gastroenteritis/Dehydration	**48**	Surgical	3
Gastrointestinal Bleed	2	Tetanus	1

Diagnosis on Discharge	Total	Diagnosis on Discharge	Total
LRTI	**121**	Trauma	3
Malaria	**411**	Trisomy 21	1
Measles	8	Tuberculosis	1
Meningitis	3	Urinary Tract Infection	5
Musculoskeletal	1	Wheeze	3
Nephrotic/Nephritic Syndrome	7		
Oesophageal Stricture	3		
Peptic Ulcer Disease	2		

Establishing the training of 12 paediatric clinicians in Phebe Hospital

This new component of the Liberian National task sharing program, which complements, and integrates with the existing task-sharing programs in advanced obstetric care and advanced neonatal care, concentrates on the training of 10 senior nurses recruited from 5 rural counties (Bong, Grand Gedeh, River Cess, River Gee, and Sinoe) plus 2 nurses from the training hospital at Phebe. The training for paediatric clinicians lasts for 2 years and 6 months.

This training program is funded by Irish Aid, undertaken by MCAI, and due to complete by the end of May 2024.

Currently in rural Liberia, children who require access to hospital because they are too ill to be cared for at home or in basic health facilities, or have severe malnutrition, or are severely injured, or need protection because of physical and sexual abuse, do not have access to the required care from adequately trained paediatricians.

Adolescent girls who are pregnant currently attend the main obstetric unit alongside adult pregnant women making it sometimes difficult for them to access services on time resulting in delays and complications.

12 paediatric clinicians are undergoing apprenticeship-based training by a national trainer (MOH and MCAI funded consultant paediatrician Dr M. Ricks) and full-time MCAI funded international advanced nurse practitioner from Nigeria (Hassan Abdulkadir) with distance learning (virtual) support and training from 7 paediatric experts based in the UK (Dr S Rowlands, Dr Alison Earley, Dr. Ahmed Elfatih Mohamed, Dr Gavin Wooldridge, Dr Yasmin Jolly, Dr Diane Watson, Dr Barbara Phillips, Prof David Southall)

As with the obstetric and neonatal clinicians who have been specifically recruited from rural counties, once trained, the paediatric clinicians will return to their counties to establish and run paediatric units at the county hospitals.

Training occurs in a renovated children's unit funded by Irish Aid through MCAI in the county hospital in Bong (Phebe Hospital).

ABOVE: *Before renovation: asbestos in the roof over the children's ward*

ABOVE: *One of the 4 wards after renovation and just before the first patients were admitted for care.*
New equipment, including nasal CPAP, oxygen concentrators and Intravenous infusion controllers funded by Irish Aid designed to improve the healthcare of very ill children has been purchased by MCAI for the new unit. A new emergency room to receive, assess and manage infants, children and adolescents has been constructed by Phebe Hospital as an extension to the existing adult emergency room (originally renovated by MCAI).

As part of the development of this new training programme, two up-to-date, evidence-based handbooks of hospital care for ill and injured infants, children, and adolescents in low resource settings, written by expert volunteer authors from all over the world, have recently been completed and published. The training curriculum is based on these 2 manuals. Click here for Handbook 1 and here for Handbook 2.

There are weekly tutorials (via Zoom) by senior international volunteer experts in hospital paediatric care from UK.

Written examinations are constructed and marked by international experts in paediatric care in low resource settings.

Please click here for the Curriculum for paediatric clinician training

Logbook for use by paediatric clinicians to document the cases they have managed during their training. (SEE BELOW)

LOG BOOK OF HOSPITAL CARE UNDERTAKEN BY PAEDIATRIC CLINICIANS

PAEDIATRIC CLINICIAN'S NAME		DATE OF ADMISSION
PATIENT'S HOSPITAL NUMBER	DATE OF BIRTH AGE ?	HOSPITAL

Male or female: Family history Any allergies:

MEDICAL PROBLEM(S) AND DIAGNOSIS

DESCRIBE MAIN TREATMENTS GIVEN INCLUDING ANY RESUSCITATION

Any complications

DESCRIBE ANY PREVIOUS MEDICAL PROBLEMS

DESCRIBE ANY FAMILY OR SOCIAL PROBLEMS

Birth wt. Any complications pregnancy or delivery

Feeding history

Immunisations so far?

Any developmental delay

DID THE **CHILD** SURVIVE? IF NOT DESCRIBE WHAT HAPPENED

Signature of trainee	Signature of trainer

Circle level of supervision As assistant Direct supervision Indirect supervision Independently

Above: *Abdulkadir Hassan, Advanced Clinical Paediatric Nurse Specialist, undertaking a ward round in the new paediatric wards.*

Draft guidelines (click here) for paediatric clinicians once they qualify and begin work in rural hospital wards are under preparation.

The paediatric clinician training timetables for year 1 and for year 2 are available here.

The summary of weekly examinations undertaken by each of the 12 paediatric clinician trainees are also available for year 1 and for year 2.

Results of the end of year 1 examination for the paediatric clinicians are available here.
Results for end of year 2 examinations for paediatric clinicis are available here.

Overview of Age of Paediatric Admissions and outcome at Phebe Hospital after the onset of training Aug 2022-July 2023

The data for this analysis has been taken from the paediatric ward admissions book.

	0-2m	3-6m	7-11m	12-23m	2-5y	6-11y	12-15y	16y+	Unknown	Total Admissions	Mortality	Against Medical Advice	Referred
Aug 2022	1	3	6	9	19	1	0	0	0	**39**	0	1	0
Sept 22	1	2	2	6	14	2	0	0	0	**27**	0	1	0
Oct 22	3	4	5	5	12	4	0	0	0	**33**	1 (3%)	2	1 (surgical)
Nov 22	2	5	4	8	17	3	1	0	0	**40**	2 (5%)	3	3

	0-2m	3-6m	7-11m	12-23m	2-5y	6-11y	12-15y	16y+	Unknown	Total Admissions	Mortality	Against Medical Advice	Referred
Dec 22	1	8	4	11	19	8	0	0	0	**51**	2 (4%)	2	3
Jan 23	7	5	6	11	11	4	1	0	0	**45**	3 (7%)	4	2
Feb 23	2	6	7	11	23	5	3	0	0	**57**	3 (5%)	3	2
Mar 23	2	7	7	10	21	4	4	0	0	**55**	3 (5%)	2	1
Apr 23	1	2	6	9	33	12	1	0	0	**64**	2 (3%)	0	0
May 23	6	11	7	21	41	4	2	0	0	**92**	4 (4%)	1	0
Jun 23	6	8	14	31	63	11	1	0	0	**134**	7 (5%)	1	2
Jul 23	4	6	12	22	74	23	7	0	0	**147**	6 (4%)	3	4
Total	36	67	80	154	351	81	20	0	0	**784**	33 (4.2%)	23	18

Diagnosis of children admitted to Phebe Hospital from August 2022 to July 2023
(Some patients have more than one diagnosis)

Diagnosis on Discharge	Total	Diagnosis on Discharge	Total
Airway Obstruction	2	Poisoning	8
Anaemia	**216**	Rape/Child abuse	**1**
Burns	4	Renal Failure	1
Candidiasis	1	**SAM**	**71**
Chronic Liver Disease including HBV	4	**Sepsis**	**116**
Congenital Heart Disease	1	Seizure Disorder	8
Diabetes Mellitus	1	Sickle Cell anaemia/Haemoglobinopathy	16
Enteric Fever/Typhoid	38	Skin Infection	43
Failure to Thrive/Moderate Malnutrition	8	Snake Bite	-
Gastroenteritis/Dehydration	**104**	Surgical	9
Gastrointestinal Bleed	1	Tetanus	5
LRTI	**94**	Trauma	2
Malaria	**513**	Syndromes i.e. Trisomy 21	1
Measles	34	Tuberculosis	7
Meningitis/Encephalitis	8	Urinary Tract Infection	13
Musculoskeletal	-	Wheeze	2
Nephrotic/Nephritic Syndrome	7	HIV	1
Oesophageal Stricture	2	Parasitic i.e. schistosomiasis	5
Orbital Cellulitis	1	? VHF	4
Peptic Ulcer Disease	3	Other neurological	59

Diagnosis on Discharge	Total	Diagnosis on Discharge	Total
Mumps	1	Malignancy	2
Pathological Jaundice	2	Other cardiac	5
Acute liver condition/ Spleen condition	3	Ear, nose, throat (ENT)	4
Endocrine	7	Other GI	1
Osteomyelitis/ Joint issues	2	Eye issues	1

ABOVE: The first 12 trainee paediatric clinicians at Phebe Hospital due to qualify in June 2024 and be working in paediatric wards at MTMH, Fishtown Hospital, Rivercess new hospital, FJ Grant Hospital, CB Dunbar Hospital and Phebe Hospital.

2. Health System Strengthening to support the training programs

For all 3 training programs, to ensure safe and high quality obstetric, neonatal, and paediatric care, it is essential that all hospitals in which the trainees (and subsequently the licensed obstetric, neonatal, and paediatric clinicians) are based, are upgraded to ensure the integrity and suitability of the buildings, such as surgical theatres, labour and delivery wards, neonatal units and paediatric wards and that necessary equipment and medical and surgical supplies are readily available.

All hospitals engaged in the training of obstetric, neonatal, and paediatric clinicians have undergone renovation and the provision of new medical equipment, emergency drugs and supplies.

MCAI also funded prior to the Ebola outbreak an extension to the Emergency Room at Phebe Hospital as well as large amounts of anaesthetic and critical care equipment for this hospital. MCAI also provided the hospital with an oxygen generator during the Ebola outbreak.

Dr Sibley, Medical Director, at the opening of the new Emergency Room at Phebe County Hospital: renovation funded by MCAI

7 neonatal intensive care units have been constructed and fully equipped and are fully operational.

8 maternity units including upgraded delivery rooms and operating theatres have received essential equipment (for examples ultrasound scanners, vacuum delivery systems, Caesarean section instruments, head torches and doppler probes).

1 paediatric unit has been completely renovated to enable the training of the first 12 paediatric clinicians and includes an emergency room for children.

Irish Aid have recently funded the renovation and equipment of paediatric wards in 4 regional public hospitals and 2 additional neonatal intensive care units in two of these hospitals.

3. Distribution of new teaching materials

Distribution of recently developed, evidence-based, up-to-date handbooks in hospital-based obstetric, neonatal, and paediatric care, specifically for low-resource settings, throughout Liberia to health workers providing care for infants, children, and adolescents (including those who are pregnant).

Electronic versions of 4 handbooks involving advanced healthcare for neonates, infants, children and adolescent girls who are pregnant are already completed and available on MCAI's website for download as PDFs (see below).

Printed versions of have already been distributed throughout Liberia.
Handbooks 1 and *Handbook 2* address in detail issues related to Liberia (as to be undertaken by paediatric clinicians) in particular:

- the assessment of nutritional status and the management of severe malnutrition
- protection of children and adolescents from abuse including sexual abuse, gender-based violence, sexual exploitation, FGM/FGC, abuse in institutions such as orphanages
- Nursing seriously ill children and adolescents up to the age of 18 years

Handbook 3 addresses neonatal critical care (as undertaken by neonatal clinicians).
Handbook 4 addresses the management of obstetric emergencies (as undertaken by obstetric clinicians).

E-Libraries for paediatric, obstetric, and neonatal care containing over 200 videos and recent peer reviewed and WHO publications are accessible on the MCAI Google Drive and have also been provided so they can be accessed without the internet on computers held by every teacher and all three groups of clinicians in Liberia.

Curricula for advanced neonatal, obstetric, and paediatric care as part of the task-sharing program are available from the MCAI website through the following links.

4. Fetal heart monitoring by mothers in labour (see PART 2 for more details)

This task-sharing program has included the involvement of mothers working in partnership with obstetric and neonatal clinicians, midwives, nurses, and doctors to improve the monitoring of fetal heart rate patterns in their unborn babies during labour and delivery, with the aim of detecting of life-threatening fetal distress and preventing birth asphyxia.

A total of 6398 participating mothers attending 4 rural hospitals since 2018 have been enrolled in a continuing program to help midwives and doctors to identify changes in fetal heart rates during labour.

5. Emergency drugs and essential emergency supplies for the hospital care of pregnant women, newborn babies and children supplied as part of this task sharing program

One of the findings in the program described here has been the consequences of the delays induced by a major, nationwide lack of essential emergency drugs and supplies in all public hospitals in Liberia present over the last 4 years. Families are frequently required to go with their own funds (often impossible because of poverty) to private pharmacies near to each hospital and buy drugs and supplies before, for example, a Caesarean section for obstructed labour can go ahead.

This problem is particularly dangerous for a country where there is extreme poverty. It has been shown in this current program of fetal monitoring by mothers (PART 2) to be an avoidable cause of many cases of severe birth asphyxia, including subsequent deaths.

MCAI has been trying to compensate (with additional support from UNICEF and Irish Aid) for the stock out of emergency drugs and supplies but inevitably, given the magnitude of need, delays in emergency treatment continue, some of which have led to maternal, neonatal and child deaths.

Additional resources provided for health system support.

All hospitals where qualified clinicians are based have major problems in the availability of vital equipment and essential emergency drugs, medical and surgical supplies. Training is difficult, if not impossible, without these essential emergency materials.

Table Some of the medical equipment provided by MCAI on behalf of the partnership	
Cooper surgical and Kiwi (Laborie) vacuum delivery kits	Pulse oximeters (Zug medical)
Portable obstetric ultrasound scanners (PUM)	Obstetric forceps
Surgical headlight torches	Nurse fob watches
Contactless thermometers (Thermoflash)	Skin to skin wraps
3-way oxygen splitters	Neonatal resuscitaires
Response FC biochemistry analysis machines	Air conditioners
Paediatric stethoscopes (Littmann)	Delivery beds
Nasal CPAP systems (Diamedica)	Intensive care beds
Major oxygen generator system for Phebe Hospital	Caesarean section delivery sets
UPS systems	Laparotomy instrument sets
Doppler ultrasound fetal heart rate monitors	Patella hammers for eclampsia management
Oxygen concentrators	8 anti-shock garments
Small oxygen storage systems based on oxygen concentrators	APEC BP monitors
IV drip stands	Ellavi Uterine tamponade devices
IPAD tablets	Low reading thermometers
Bed mattresses	Samsung computer tablets
Spinal needles	ASUS laptops
Surge protectors	iPhones
Blood glucose monitors	
Urine testing sticks (multi-test) Durbin	

Table of Emergency drugs for both maternity and neonatal care provided by MCAI on behalf of the partnership	
Neonatal	**Obstetric**
IV Ceftriaxone, Gentamicin, Flucloxacillin, Ampicillin, Benzyl penicillin, Metronidazole	IV Ceftriaxone, Gentamicin, Flucloxacillin, Ampicillin, Benzyl penicillin, Metronidazole
Vitamin K	Oxytocin and Misoprostol
Glucogel 40% glucose	Adrenaline and Ephedrine
Lidocaine 1%	Marcaine and spinal needles
Tetracycline eye ointment	Tramadol and IV paracetamol
Phenobarbital	Tranexamic acid
Multivitamins for neonates	
Rectal paracetamol	

Emergency drug kits given to each trainee obstetric clinician.

Emergency Paediatric drugs supplied to Phebe Hospital for training support

- Adrenaline
- Prednisolone
- ReSoMal
- ORS
- Vitamin A
- Morphine (difficult to get but should be on our list to work towards)
- Ampicillin, Gentamicin, Ceftriaxone,Metronidazole
- Hydrocortisone
- Dextrose 50%
- IV fluid for resuscitation (RL or NS)
- IV Artesunate
- Diazepam (PR or IV)
- Analgesia for severe pain: IV paracetamol, Tramadol
- Salbutamol inhalers and nebules for nebuliser

These drugs cover the majority of emergency admissions: severe malaria, sepsis, seizures, hypoglycaemia and shock, severe asthma, sickle cell crises.

ABOVE; *A portable ultrasound scanner for advanced obstetric care of pregnant women provided to CB Dunbar Hospital. Similar scanners were provided to Redemption, MTMH, FJ Grant and CH Rennie Hospitals.*

ABOVE: Because of the unreliability of electrically powered oxygen supply systems (oxygen concentrators), during the Ebola outbreak, MCAI provided an oxygen generator system based at Phebe Hospital that produces large cylinders full of medical grade oxygen for 4 nearby hospitals, including CB Dunbar Hospital

As a result of frequent losses of electrical power, required to keep machines that supply respiratory support and oxygen, as well as electronic monitoring, MCAI provided a power supply that automatically links to equipment to receive power from a large battery available in the neonatal high dependency ward.

Maintenance of equipment is also a crucial issue and MCAI has been working with a biomedical engineer to help provide support to hospitals in maintaining equipment.

BELOW: The respiratory support system, non-invasive nasal CPAP, provided for the care of newborn infants with respiratory failure

Courses in medical ethics and professional standards

Following a request from the Late Deputy Minister for Curative services, Dr. Saye Baawo [RIP], and The Registrar of the Liberian Medical and Dental Council, Dr. Nyaquoi Kargbo, a 3-day course in medical ethics and professional standards was undertaken by the Partnership during 2015.

Please find links here for the one day medical ethics courses undertaken by obstetric, neonatal, and paediatric clinician trainees undertaken at the onset of their training.

ABOVE: Dr. Baawo addressing the first 3-day conference on medical ethics and professional standards in Monrovia July 2015.

A checklist for ethical systems to be developed for healthcare in Liberia was presented to the MOH.

Enhanced monitoring of maternal, newborn and child deaths in Liberia; MNCADSR

MCAI working in partnership with The Family Health Division of the Liberian MOH until 2022, and through an existing Irish Aid grant, funded the salary of the convenor of the MNDSR program (Mrs. Suena Sambola) currently now based in and funded by the MOH with financial communication support from MCAI).

MCAI are requesting that this program will work with the FHD of the MOH to expand the national Maternal, Neonatal Death Surveillance Review (MNDSR) to include children and adolescents (so become MNCADSR)

A data collector (and RN) was appointed in October 2021 by MCAI (Jessica Fofana) who is responsible for recording key information on maternal, neonatal, child and adolescent deaths, hospital admissions, and ill-health and abuse in the 5 counties, with a view to expanding the data collection with the help of WHO and UNICEF, to establish a data monitoring system for child and adolescents throughout Liberia, which currently does not exist.

Renovation and equipment for 3 more neonatal intensive care units and 4 new paediatric units in the 4 SE sector hospitals

- In third year of this Irish Aid funded program, 2 neonatal intensive care units in River Cess (New Hospital); Fishtown, River Gee will be established (by renovation and with equipment)
- FJ Grant, Sinoe and Martha Tubman Memorial Hospital in Grand Gedeh already have NICUs.
- 4 paediatric in-patient wards will be established in the 4 designated hospitals in the South-East (FJ Grant, Fishtown, Rivercess (new hospital) and Martha Tubman)
- These NICUs and 4 paediatric units will be run by neonatal and paediatric clinicians respectively, recruited from these rural counties so that each of these 4 county hospitals can provide quality care to neonates, children, and adolescents.

Sustainable Change Requires Teamwork

Liberian staff responsible for this program

Special thanks to the following: Amos Davis BSc (MCAI Representative and Program Manager), Jeremiah Akoi BBA, MBA (Finance Manager), Austine Menlor Jr BBA, AA Logistician South-eastern region, Nurse Jessica Fofana Diploma in Nursing Data manager and coordinator fetal monitoring by mothers program, Nurse Christopher F Kendema BSc, Deputy data manager, Loila Kwapaigei Housekeeper for House 13 Phebe Compound and George Barpee, Driver and Office support worker SE region.

CONTACT:Honorary Medical Director MCAI, 1 Columba Court, Laide, Highland, Scotland. IV22 2NL,

UK Mobile 0044 (0) 7710 674003
https://www.mcai.org.uk

Registered as a SCIO (Scottish Charitable Incorporated Organisation) No. SC043467

MCAI Liberia, House 13, Phebe Hospital, Liberia Enterprise Number 051730402

Appendix 1 Liberia Obstetric Outreach Clinics: Report to Irish Aid for year August 2022 – July 2023

By Dr Diane Watson, Volunteer Obstetric Anaesthetist and Obstetric Outreach data co-ordinator, MCAI.

Background

A need for more clinicians trained in diagnosing and treating pregnancy and delivery complications was recognised following a countrywide assessment of health facilities in 2013. This need was greatest in the rural areas of Liberia and instigated training of obstetric skills to midwives to become obstetric clinicians after successfully completing 3 years of training in advanced obstetrics.

These midwives have had training in advanced obstetrics including managing medical conditions during pregnancy, pregnancy specific conditions, practical obstetrics, and ultrasound scanning and are identified and qualified as obstetric clinicians.

Since 2019, obstetric clinicians and a logistician have been travelling from their base hospitals to different rural clinics once a month to identify pregnant women at high risk of morbidity and mortality during labour and delivery. 'High risk' women are identified from obstetric and medical history, examination, and ultrasound scan. Women attending community outreach clinics live in remote areas and for socioeconomic reasons cannot attend central clinics or get to hospital quickly during labour.

The first county to benefit from outreach clinics was Grand Gedeh. Since then, as more obstetric clinicians were trained, and funding became available from Irish Aid, other counties having outreach clinic facilities have been River Gee, Sinoe and, this year, River Cess.

Travel to clinics

-Austine LT Menlor jnr, MCAI logistician for South-East Liberia, arranges the clinics attended each month.
-The Community Health Officers (CHOs) in Grand Gedeh and River Gee have intermittently agreed to provide their 4-wheel drive vehicles for Outreach clinics. MCAI pays for the fuel and washing of these vehicles.
-The obstetric clinicians in River Cess and Sinoe use motorbikes.
-The obstetric clinicians carry an ultrasound machine, and other equipment to check for early signs of pregnancy complications (blood pressure machine, urine sticks for protein and glucose as well as an emergency medical kit, containing basics for the initial management of obstetric emergencies).

Benefits of Outreach clinics

Antenatal Diagnosis

Clinical features can identify pregnant women at high risk of having complications during labour. Ultrasound scanning performed in Outreach clinic adds to the clinical diagnosis of high-risk pregnancies and can reveal potentially life-threatening obstetric disorders (eg placental pathology, malpresentations, IUFD) and manage them. Pregnant women can also see their fetus moving, and any causes for concern can be explained, such as malpresentation and low-lying placenta.

Plan for delivery

During the clinic appointment, women can be advised on further antenatal care needed; for example, repeat ultrasound scans later in pregnancy, and advice on benefits of hospital delivery if high-risk.

If women are in late pregnancy, they can be advised to deliver in hospital if they are recognised as high risk for delivery complications. The obstetric clinician can start the consent process, discuss options for delivery, address any concerns, and arrange a date for the woman to attend the hospital, and to attend early in labour if appropriate.

If Caesarean section is recommended, obstetric clinicians can explain the benefits and risks of Caesarean section versus vaginal delivery and start the consent process well in advance of admission to hospital. If the woman needs to stay near the hospital close to term in case of complications (eg. Early labour, antepartum haemorrhage) needing an urgent Caesarean section, this can also be recommended.

There is also opportunity for future **family planning** to be discussed.

If symptoms and signs requiring urgent hospital admission are recognised, emergency treatment available in the clinic can be given and the woman transported to hospital by ambulance.

Women are identified as high risk if the following are found:

- Medical conditions for example diabetes
- Obstetric conditions for example hypertensive disorders
- Maternal age: <17yrs and >39yrs
- Grand multipara: parity > 3
- Multiple pregnancy
- Malpresentations
- Abnormal placentation
- Post maturity by women's dates and evidence on ultrasound scanning of placental calcification

Changes were made to the criteria for high risk in the past year were:

1. Breech presentation to be considered high risk after 34 weeks' gestation. This change is because most fetuses presenting as breech before this time will be cephalic by 36 weeks'

gestation. High risk is now considered at 34 weeks' gestation or later and further management noted. This accounts for the decrease in numbers of malpresentations reported this year compared with the previous report.

2. Placenta previa (low lying placenta): this condition is considered high risk if seen at or after 32 weeks' gestation because a low-lying placenta seen on ultrasound scan before this time may not be low-lying at 32 weeks' gestation. The obstetric clinicians advise women with a low-lying placenta in the first or second trimester to be rescanned in the hospital when she reaches 32 weeks' gestation.

The map below shows the location of major hospitals in Liberia (indicated by a blue square with a 'H' inside). four counties involved in the obstetric outreach programme – Grand Gedeh, River Gee, Sinoe and River Cess. The hospitals in the four counties involved in the outreach programme are circled in red – Martha Tubman Memorial Hospital and Fish Town Hospital in the south-east and, FJ Grante Hospital and St Francis Hospital in the south west

Overview of data collected.
Combining data from Grand Gedeh, River Gee, Sinoe and River Cess counties: a total of **1619** women were seen, and **616 (38%)** identified as high risk according to the criteria. A total of **118** clinics were visited in the 4 counties.

Women assessed in Outreach clinics from September 2022 – June/July 2023

County	**Base hospital**	**no. of women seen in outreach**	**no. of women identified as high risk**
Grand Gedeh	Martha Tubman Memorial Hospital	544	198
River Gee	FishTown Hospital	207	56
Sinoe	FJ Grante Hospital	711	291
River Cess	St Francis or the Newly built Hospital	157	71
Total all counties		**1619**	**616 (38%)**

Data from Individual counties
(all population numbers are from the 2008 census)

Grand Gedeh: (pop: 126,146; area km^2: 10,464)

Hospital base**: Martha Tubman Memorial Hospital**
Obstetric Clinicians**: Emmanuel Hine/ Joyceline Kudee**
Logistician: **Austine LT Menlor Jnr**

Clinics, number of patients seen and those identified as high risk.

Month	**Clinics attended**	**Number of women assessed**	**Number of women identified as high risk**
September 2022	Zai Town, Gbarzon, PTP. **3**	60	23
October 2022	Karlorwleh, Konobo, Boundary **3**	44	16
November 2022	Tuzon, Pennonken, Gborbowraga. **3**	33	13
December 2022	Boundary, Bargblor, Janzon. **3**	23	9
January 2023	Gbarzon Duogee, Toetown. **3**	88	28
February 2023	Beh, Zai, Putu Karlorwleh, Putu Jarwodee. **4**	46	15
March 2023	Konobo, Boundary, PTP **3**	66	26
April 2023	Gbarzon Polar, Gbarzon Health, Kumah. **3**	52	18

Month	Clinics attended	Number of women assessed	Number of women identified as high risk
May 2023	Gborgbowrogee, Jarwodee, Pennonken. **3**	52	22
June 2023	Bargblor, Zai, Jarzon. **3**	39	14
July 2023	Gboleken, Duogee **2**	41	14
Totals	**33**	**544**	**198 (36%)**

544 women were seen in 33 outreach clinics between September 2022 and July 2023, 198 (36%) were identified as high-risk.

143 of the women identified as high risk were grand multips, some with additional risk factors.
Other risk factors: >39yrs old 29; <17yrs old 20; multiple pregnancy 11; malpresentations 9; previous Caesarean section 9; post maturity 3; placenta previa 2.

Serious maternal complications MTMH
There was **one maternal death** in those flagged as high risk and the cause was not due to obstetric reasons. This woman was high-risk because she had 2 previous caesarean sections and was booked for a planned caesarean section. Collapse occurred almost immediately after injection of spinal anaesthetic by a very experienced anaesthetist. All attempts were made to resuscitate her, including delivery of her baby, but resuscitation was unsuccessful. The baby was healthy.

A second maternal death occurred a few days later with a similar time relationship to the spinal anaesthesia being injected. All ampoules of spinal injection in the same batch were removed from the operating theatre and replaced. There has been no further problems with spinal injections.
The ampoules were returned to the pharmacy and MOH for analysis, but the specific contents have not been analysed to my knowledge.

Case examples from Emmanuel – Grand Gedeh
[In reports below *(G – number of pregnancies, P – number of deliveries at >28 weeks' gestation, M – number of miscarriages, L – number of living children, D – number of dead children)]

Case 1 Grand Gedeh
EN, 45yrs of age, G9 P6 M2 Ln6* had previous caesarean section for obstructed labour and was referred to MTMH due to her age and gravidity and previous caesarean section history but didn't come until she got in labour at the Toe town clinic. Cesarean section was done August 11,2023

Case 2 Grand Gedeh
JP 18yr G2, p0, M1* Patient was referred due to oblique lie with grade 2 placental calcification and has a short stature. The baby was born by Cesarean section on July 28, 2023 with baby weight 3.6kg

Case 3 Grand Gedeh
VT 36yrs, G4, P3 Ln1* had previous caesarean section due to previous ruptured uterus both posterior and anterior and 2 previous stillbirths. Patient was referred to MTMH for elective caesarean section because of previous ruptured uterus

River Gee: (pop: 67,318, area km^2: 5,113)
Hospital base**: FishTown Hospital**
Obstetric clinician**: Noah Jasper**
Logistician: **Austine LT Menlor jnr**

207 women were seen in **30** outreach clinics between September 2022 and June 2023
56 (27%) women were identified as high risk.

River Gee Clinics, women assessed, high risk identified.

Month	**Clinics attended**	**Number of women assessed**	**Number of women identified as high risk**
September 2022	Pronoken Tuobo Jayproken. 3	26	7
October 2022	Glaro Freetown Gbeapo Putuken. 3	23	13
November 2022	Jarkaken Gmamanken Cheboken. 3	14	3
December 2022	Gbeapo Nyenanbo Glaro Ubor 3	23	7
January 2023	Jimmyville Tuobo Joelbo. 3	23	6
February 2023	Jarkaken Putuken Pronoken. 3	27	5
March 2023	Gbeapo River Gbeh Sarbo. 3	24	6
April 2023	Nyananabo Freetown Drubo 3	15	2

Month	Clinics attended	Number of women assessed	Number of women identified as high risk
May 2023	Jayproken Pronoken Jarkaken. 3	17	5
June 2023	Nyenyanken Kellipo Datuken 3	15	2
Totals	**30**	**207**	**56 (27%)**

Of those recognised as high risk, most (18) were grand multipara, there were 9 women who had malpresentations and 9 who were >40 weeks' gestation. 14 women were <17yrs old.

Four women had undergone previous caesarean sections.
Six women presented to the health centre with eclampsia or severe pre-eclampsia needing emergency treatment and transfer to hospital.

Case examples from River Gee

[In reports below *(G – number of pregnancies, P – number of deliveries at >28 weeks' gestation, M – number of miscarriages, L – number of living children, D – number of dead children)]

Case 4 River Gee

38yr old, G13 P7 M1 L6*
Seen in Gbeapo Health Centre in antenatal clinic on March 27 2023
39 weeks gestation
History of previous intrapartum stillbirth because of difficult delivery due to large fetal size
Ultrasound findings in clinic: Breech presentation, estimated fetal weight: 4.6kg. Grade 2 placental calcification.

On basis of history and findings, patient advised to be delivered by Caesarean section. Patient and relatives agreed and transfer to hospital by ambulance was arranged.
The woman was delivered on April 1 by Caesarean section. She experienced an immediate postpartum haemorrhage estimated at 1500ml which was. Treated with oxytocin infusion, misoprostol and tranexamic acid 1g.
No blood was transfused and post op Hb was 10.5g/dl (pre-op Hb was 12.5g/dl)

Case 5 River Gee

A 22yr old woman was seen in Jarkaken Clinic by Noah Jasper. She was 38 weeks' gestation in her first pregnancy. She complained of epigastric pain and her blood pressure was 169/100.
Ultrasound examination showed a twin pregnancy with both twins lying transverse.
She was given initial treatment for severe pre-eclampsia and transferred to Fishtown Hospital.
She delivered twins the following day by Caesarean section. There were no maternal complications and Hb was 12g/dl after surgery.

The babies did well and did not need to go to the neonatal unit.

Case 6 River Gee
A 37yr old grand multip (G9 P4 M1 L4) was seen in Gbeapo Clinic. She was 42 weeks' pregnant confirmed by ultrasound scan, which showed anhydramnios, grade 3 placental calcification and an estimated fetal weight of 4.6kg.
She was transferred with her consent and had a Caesarean section the same day.
Mother and baby did well and were discharged from hospital after 4 days.

Sinoe: (pop: 104,932, area km^2: 10,137)
Hospital base: **FJ Grante**
Obstetric clinician: **Osee Fiah**
Logistician**: Austine LT Menlor jnr**

711 women were seen in 36 outreach clinics between September 2022 and July 2023. 291 (41%) women were identified as high risk.

The numbers of women in each of the high risk categories were:
Grand multips: 202, age <17yrs: 47, previous Caesarean section: 19, Malpresentation: 13
15 women seen in the clinics were treated as emergencies with eclampsia/ severe pre-eclampsia and given initial emergency treatment and transferred from clinic directly to FJ Grante Hospital

Examples of women seen in Outreach clinic
[In reports below *(G – number of pregnancies, P – number of deliveries at >28 weeks' gestation, M – number of miscarriages, L – number of living children, D – number of dead children)]

Month	**Clinics attended**	**Number of women assessed**	**Number of women identified as high risk**
September 2022	Juayen Kerquekpo Menwah Walker 3	93	33
October 2022	Butaw Wiah's Town BOPC 3	87	31
November 2022	RTM Gbason's Town Juarzon. 3	53	24
December 2022	Kwitatuzon Tubmanville Saywon Town 3	58	29
January 2023	SRC Diyangpo Government camp (2days) 4	137	46
February 2023	Kabada Panama Kilo Town Lexihtone. 4	98	45

Month	Clinics attended	Number of women assessed	Number of women identified as high risk
March 2023	Edward mem Juayen Tuzon. 3	31	11
April 2023	Jokaken Nyanwiaken Ducorfree 3	32	17
May 2023	Jacksonville Togbaville (2 days) ENI 4	43	17
June 2023	Voorgbardee Pyne's Town Pelloukon. 3	35	15
July 2023	Drapo Kabado Panama. 3	44	23
Totals	**36**	**711**	**291 (41%)**

Case 7 Sinoe
A 33yr old grand multipara (G8 P5 M2 L5) presented at Tubmanville Health Centre at 33 weeks' gestation with a history of ruptured membranes.
Ultrasound scan confirmed severe oligohydramnios, confirmed prolonged premature rupture of membranes and fetal death.
She was transferred to hospital and delivered a stillbirth vaginally the next day. She received IV antibiotics.

Case 8 Sinoe
A 36 yr old grand multipara (G7 P6 M2 D2) attended the ENI clinic and reported a week's history of vaginal bleeding in early pregnancy. Ultrasound confirmed retained products of conception and she was counselled and advised to go to FJ Grante Hospital for removal of retained products. She could not go because she had no money but agreed to management in the clinic.

Case 9 Sinoe
A 31yr old grand multipara (G8 P6 M1 L5 D1) attended Voorgbardee Clinic. She was 4 weeks after her due date and this was supported by placental calcification and oligohydramnios on ultrasound scan. She was counselled and attended hospital for induction of labour. This was followed by a live baby born by normal vaginal delivery with no postpartum complications reported.

River Cess: (pop: 65,862[1], area km[2]: 5,594)
Hospital base**: St Francis**
Obstetric clinician**: Ariza Jolo, Lewis Toe (final year trainee)**
Logistician: **Amos Davis**

157 women were seen in 19 outreach clinics between January 2023 and July 2023 with 71 (41%) identified as high risk.

River Cess – Clinics started Jan 2023 – women assessed and identified as high risk

Month (2023)	**clinics attended**	**number of women assessed**	**Number of women identified as high risk**
January	River Cess Ref hosp (3 days) OBS. 4	19	7
February	Charlie Town Timbo Fen River 3	22	12
March	Gblorseo Dorbor Sayah. 3	20	13
April	Bolowhea Larkpasse Boegeezay. 3	37	25
May	Kangbo Gozhon. 2	20	8
June	Neezine ITI. 2	20	4
July	Fen River Charlie Town 2	8	1
Totals	**19**	**157**	**71 (45%)**

The numbers of women in the high risk categories were:
Grand multipara: 36, age <17yrs: 18, Malpresentation: 8, post maturity: 8, previous Caesarean section: 5, age > 39yrs: 5

Case examples from River Cess [In reports below *(G – number of pregnancies, P – number of deliveries at >28 weeks' gestation, M – number of miscarriages, L – number of living children, D – number of dead children)]

Case 10 Rivercess
A 40 yr old lady attended Boegeezay Clinic
Obstetric history: G12 P8 L5 D3
32 weeks' gestation in current pregnancy. Advice was given to deliver in hospital because grand multip.
She attended the hospital at term. She was delivered by Cesarean section due to prolonged obstructed labour. She had a postpartum haemorrhage and was treated with oxytocin, misoprostol 800mcg and condom tamponade. Mother recovered and baby had no problems

Case 11 Rivercess
A 30 yr old woman presented to Timbo Clinic. She was 30 weeks' gestation in her 7th pregnancy. She was advised to come to hospital to deliver because of her parity and risk of postpartum hemorrhage.
She was in labour in the clinic and started bleeding. She had a vaginal delivery of a stillborn baby and then had a massive postpartum hemorrhage (PPH). She was transferred to hospital, was treated, and survived.

Case12 Rivercess
A 16 yr old primigravida was seen in clinic and was 42 weeks into her pregnancy. Ultrasound scan showed oligohydramnios, calcified placenta and the fetus was macrosomic with an estimated fetal weight of 4.4kg. She was transferred to hospital the same day and was delivered by caesarean section 3 days later. There were no postnatal problems, and the baby was healthy.

Benefits of Outreach clinics

1 Link between hospital staff and pregnant women.
2 Link between hospital and community workers.
3 Highlight potential problems in pregnancy by clinical examination and ultrasound scanning.
4 Community nurses and midwives able to refer and discuss pregnant women they have concerns about
5 Counselling pregnant women and reinforcing need for regular antenatal clinic attendance and malaria prophylaxis.
6 Explaining individual risk to women of delivering in hospital, health centre or at home, depending on circumstances
7 Able to transfer women with antenatal complications that require emergency treatment in hospital.

Limitations of Outreach Clinics
1 limited numbers of clinics attended by an obstetric clinician – clinics are visited once or twice a year.
2 poor roads and transport to hospital for staff travelling to clinics. This occurs in all 4 counties. Some clinics in Sinoe take 2 days' travelling each way, especially those involving a river crossing.
3 For women advised to attend hospital, the situation is worse. For example, in Sinoe it may take one week in a car from the remote areas of the county to FJ Grant Hospital
4 For socioeconomic reasons, women may not be able to go to hospital. In some areas, the husband or other members of the family will be influential in the decision, the woman may have to look after other children or need to work. Financial constraints play a big part in the decision.
5 If the above barriers are overcome and a woman reaches hospital there are further obstacles before receiving appropriate treatment. If a caesarean section is recommended, the family often needs to pay for materials and drugs, and blood transfusions if donors outside the family are needed.

Summary of obstetric outreach program currently involving 1 of the 4 hospitals where FHR monitoring is in place.

- Undertaken by 5 qualified obstetric clinicians in 3 counties in the most rural South-East of Liberia with support from MCAI logistician to clinics and refugee camp.
- Includes obstetric ultrasound examination for all pregnant women.

- Includes emergency kit to provide immediate investigation and treatment for emergencies such as APH and severe pre-eclampsia.

- Total Outreach to date = 1,450 pregnant women seen; total high risk 665

(Grand Gedeh October 2019 to December 2021, Rivergee July 2020 to February 2022)
Many serious previously un-recognised conditions (for examples placenta praevia, severe pre-eclampsia, multiple gestation, malpresentations, teenage pregnancies, grand multiparity,) identified, referred to hospital when appropriate and managed.

Obstetric clinicians currently attend 4 rural counties undertaking outreach antenatal clinics from their base hospitals. They are accompanied by a logistician once a month to identify antenatal women at high risk of morbidity and mortality during subsequent labour and delivery. 'High risk' women are identified from an obstetric and medical history and examination, urine testing, and when appropriate blood tests and portable battery-operated obstetric ultrasound scans.

Women attending these community outreach clinics live in remote areas and, for socioeconomic reasons, cannot reliably attend central clinics or reach hospitals in time once labour begins.

High risk categories identified at outreach include:
• Medical conditions: for example, severe untreated anaemia (often as low as 3g/dl), malnutrition, diabetes, chronic hypertension or renal impairment and heart conditions
• Obstetric conditions: for example, hypertensive disorders (pre-eclampsia and in particular severe preeclampsia and eclampsia), abnormal placentation such as placenta praevia and placental abruption, infections (chorioamnionitis and previously undetected intrauterine fetal deaths)
• Maternal age:< 17yrs and > 39yrs
• Grand multiparity
• Multiple pregnancy
• Malpresentations such as breech, transverse, and obliques presentations after 34 weeks' gestation.
• Post maturity by women's dates and evidence on USS of placental calcification and intrauterine growth retardation.

Until obstetric clinicians began visiting there had been no ultrasound facilities in the far-away remote clinics. This development means that for the first-time pregnant women could see their alive fetus.

Potentially life-threatening disorders were managed before there were tragic consequences. Sometimes immediate treatment was needed, and women transferred by ambulance, car or motorbike to the nearest CEmONC hospital after stabilisation such as magnesium sulphate and hydralazine for severe preeclampsia and extremely high blood pressures, blood transfusion for severe anaemia.

Planning for birth following obstetric outreach clinics.
The obstetric clinician undertaking the clinic can discuss options for delivery, answer questions and arrange a date for the woman to attend the hospital, and to attend early in labour if it begins before the date given.

This situation prepares the women for a potentially frightening experience and having contact with the same obstetric clinician when they arrive in hospital can be reassuring. If patients need Caesarean sections to help prevent maternal or fetal compromise or death, obstetric clinicians can explain why, and start the consent process in advance of admission to hospital.

If the woman needs to stay near the hospital close to delivery in case of complications needing an urgent Caesarean section (for example antepartum haemorrhage from placenta praevia), this can be stressed. It has been known on some occasions for women to stay in the obstetric clinicians' own homes before delivery if they do not know anyone living close to the hospital and cannot afford to pay for accommodation.

Breech malpresentation is a known major risk factor for birth asphyxia. Women who have been diagnosed as having breech malpresentations at or near term can be advised to deliver in hospital to help prevent birth asphyxia. If a breech is diagnosed early in the third trimester, recommendation can be made for a repeat ultrasound examination later in pregnancy to confirm or refute malpresentation.

Two additional obstetric outreach programs in River Cess and Sinoe will join the established obstetric outreach programs in Grand Gedeh and River Gee to ensure that high-risk pregnant women/adolescent girls in all clinics are adequately identified and managed.

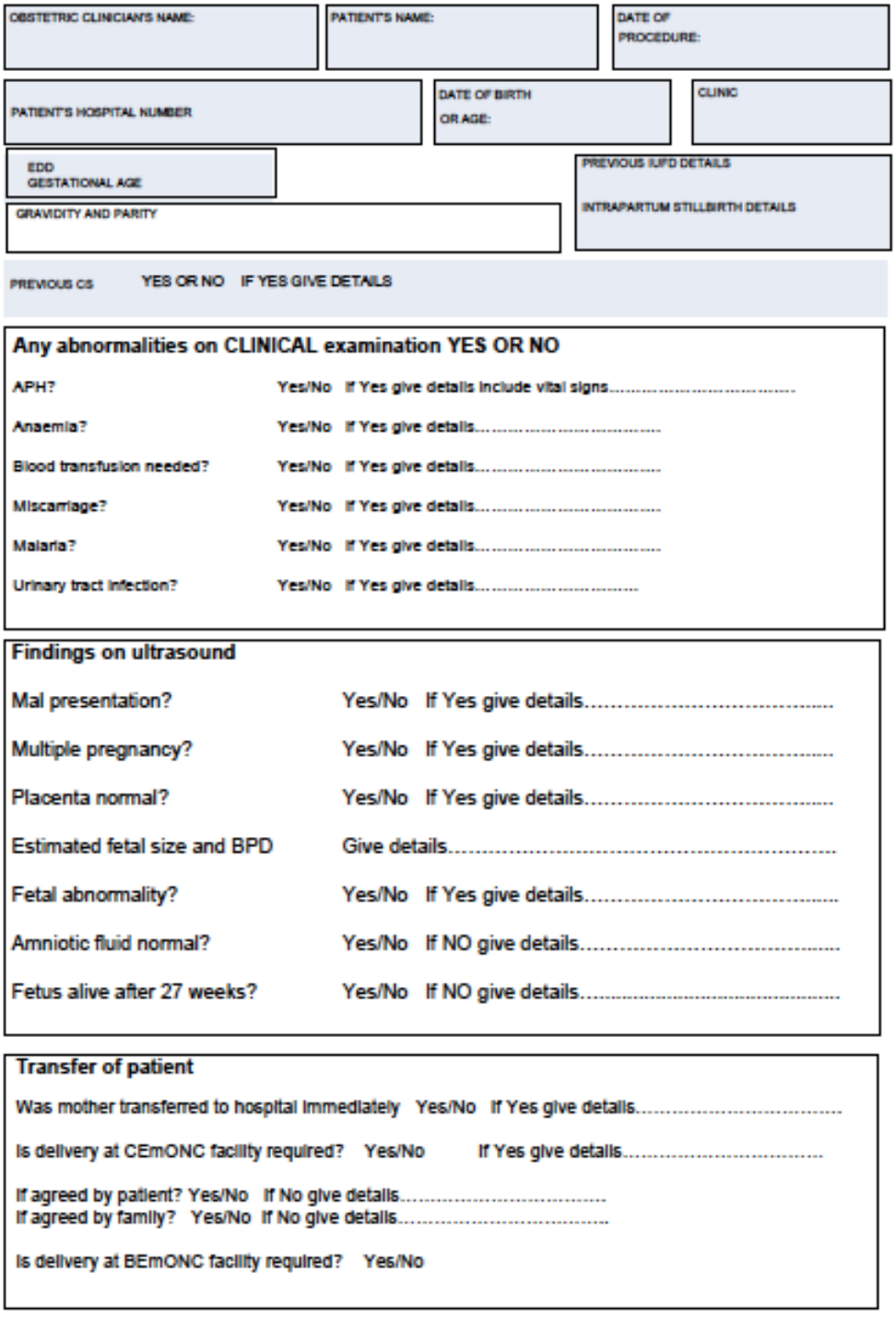
In this program, an Obstetric Clinician equipped with an investigation and emergency treatment kit, including a portable ultrasound scanner, attends antenatal clinics to identify women with high-risk pregnancies.

The obstetric clinicians implement an appropriate clinical management plan, and crucially, ensure that each at-risk woman/ adolescent girl is followed up to ensure that they come to either the CEmONC or BEmONC facility for their continued care and delivery.

ACTION POINTS

1. MCAI to procure and ship 2 additional portable ultrasound scanners plus emergency diagnostic and management kits to St Francis and FJ Grant hospitals.
2. MCAI to obtain additional small portable generators needed for keeping the ultrasound scanners charged for outreaches to the most far away clinics.
3. FHD and MCAI to identify the county transport needed safely to undertake these outreach visits.
4. Qualified obstetric clinicians to be identified and trained to undertake the outreach work based on experience in Grand Gedeh and RiverGee
5. The findings on all patients seen in the clinics and their outcomes will be documented into logbooks (printed and electronic) connected to the MCAI database in Scotland.
6. MCAI logisticians to oversee these visits to the clinics and the data collection and transfer.

Logbook for collecting data from each patient seen in obstetric outreach work in far-away antenatal clinics.



OBSTETRIC CLINICIAN'S NAME:	PATIENT'S NAME:	DATE OF PROCEDURE:
PATIENT'S HOSPITAL NUMBER	DATE OF BIRTH OR AGE:	CLINIC
EDD GESTATIONAL AGE		PREVIOUS IUFD DETAILS INTRAPARTUM STILLBIRTH DETAILS
GRAVIDITY AND PARITY		
PREVIOUS CS	YES OR NO	IF YES GIVE DETAILS

Any abnormalities on CLINICAL examination YES OR NO

APH?	Yes/No	If Yes give details include vital signs.....
Anaemia?	Yes/No	If Yes give details.....
Blood transfusion needed?	Yes/No	If Yes give details.....
Miscarriage?	Yes/No	If Yes give details.....
Malaria?	Yes/No	If Yes give details.....
Urinary tract infection?	Yes/No	If Yes give details.....

Findings on ultrasound

Mal presentation?	Yes/No	If Yes give details.....
Multiple pregnancy?	Yes/No	If Yes give details.....
Placenta normal?	Yes/No	If Yes give details.....
Estimated fetal size and BPD	Give details.....	
Fetal abnormality?	Yes/No	If Yes give details.....
Amniotic fluid normal?	Yes/No	If NO give details.....
Fetus alive after 27 weeks?	Yes/No	If NO give details.....

Transfer of patient

Was mother transferred to hospital immediately Yes/No If Yes give details.....

Is delivery at CEmONC facility required? Yes/No If Yes give details.....

If agreed by patient? Yes/No If No give details.....
If agreed by family? Yes/No If No give details.....

Is delivery at BEmONC facility required? Yes/No

A case history of a recent obstetric outreach case

Patient aged 14 yrs. Attended clinic at 26 weeks' gestation in shock. HR 128/min, RR 32/min, BP 90/50, T 35.2 C, SaO2 90%. Immediately placed in an ambulance and transferred to MTMH.

On arrival at the hospital at 1445 hrs. patient was placed in left lateral tilt and placed on oxygen at 6 liters per minute, 2 iv lines were established with 18g cannula. Hb was only 5g/dl, 0.9% saline 1 liter iv stat at highest flow rate and Ampicillin 2g iv stat was served. Foley catheter was inserted.

- Relatives were counselled to provide two units of blood. At 1500 hrs. the first unit of blood O+ was set up at 37 drop per minute. (packed cell). She was transfused for two hours and ended with no reactions.
- Patient's vital signs were monitored every 15 minutes for the first one hour. Every 30 minutes for two hours including fetal heart rates.
- The Artesunate protocol for malaria was initiated.
- Frusemide 40mg iv stat was also served.
- At 11pm a second unit of O+ blood was transfused for 4 hrs. with no reactions.
- Patient was placed on Vit. C, 500mg, Fefa 1 tab p.o bid x 14 days, Amoxicillin 500mg p.o. tid x 5days and Multivitamins 1 tab p.o. qds x 7days.
- Patient was discharged home on day 7.

Appendix 2: Training by neonatal clinicians for nurses and midwives in clinics providing Basic Emergency Obstetric Care in 4 rural counties in the poorest sector of Liberia.

In an integrated approach to provide the continuum of care, in a complementary program, emergency neonatal resuscitation platforms, specially designed for undertaking neonatal resuscitation in low-resource, tropical settings, have been provided to 18 remote basic clinics (BEmONCs) in 4 rural counties (Grand Gedeh, River Gee, Rivercess, Sinoe). If funds allow a further 4 platforms will be established in the CEmONC facilities in the 4 designated counties. Each platform is accompanied by a bag and mask inflation and manual suction systems.

These 18 clinics have been selected by their number of deliveries and long distance from the county hospital (CEmONC)

All skilled birth attendants in each selected facility will be trained in neonatal resuscitation and the use of resuscitation platforms by the qualified/intern neonatal clinicians based at each CEmONC with support from the obstetric clinician undertaking the outreach.

Local MCAI logisticians will support the integrated obstetric outreach and neonatal resuscitation programs in each county and be responsible for the data collection. MCAI logisticians to ensure that all neonates who have been resuscitated and their outcomes are documented into logbooks kept in each facility and scanned and returned to MCAI in Scotland for analysis.

MCAI logisticians to ensure that all neonates who have been resuscitated and their outcomes are documented into logbooks kept in each facility and scanned and returned to MCAI in Scotland for analysis.

Training Report

DATE: June 2023; July 2023 August 2023

Venues:

A. **GRAND GEDEH COUNTY HEALTH FACILITIES**
   Konobo Health Center- 8 skilled birth attendants, JULY 19,2023
   PTP Clinic - 6 skilled birth attendants, AUG.16, 2023
   Putu Pennonken Clinic - 5 skilled birth attendants, AUG. 10, 2023
   Gbarzon Health Centre – 6 skilled birth attendants JULY 21, 2023
   Jarzon Clinic - 5 skilled birth attendants and AUG. 21, 2023
   Toe Town Clinic – 4 skilled birth attendants JULY 24,2023

   Total of Skilled birth attendants trained in Grand Gedeh is 34

B. **SINOE COUNTY HEALTH FACILITIES**
   Butaw Clinic -4 skilled birth attendants, JULY 6, 2023
   RTM Clinic -5 skilled birth attendants, JULY 14, 2023
   Wiah Town Clinic 6 skilled birth attendants and JULY 16, 2023
   FJ Grante OB ward and OT staff - 18 skilled birth attendants JULY 18, 2023

   Total skilled birth attendants trained in Sinoe is 33

Title of Training: neonatal resuscitation and identification and management of neonatal emergencies

Introduction/Background: It is widely known in Liberia that most new-borns needlessly die because skills birth attendants don't have the knowledge, skills, and basic equipment to perform effective neonatal resuscitation. MCAI

and its partner (Irish Aid) have conducted training in remote basic six (6) facilities with high delivery rates in Grand Gedeh County and three (3) rural health facilities in Sinoe County.

Objectives: To conduct training for skilled birth attendants in rural facilities in neonatal resuscitation, usage of resuscitation platform, and the identification of seriously ill neonates needing urgent transfer to the county CEmONC facilities to be attended by Neonatal clinicians and other skilled birth attendants.

Discussion and training activities:
Facilitators (Neonatal Clinicians, County Reproductive Health Officer, Biotechnician) trained 67 skill birth attendants in Ten (10) facilities on how to use the resuscitation platform and how to record the results of those new-borns that were resuscitated.
They were also trained on the pathway of early referral of the critically ill new-born infant.
The training was interactive because those skill providers already have some knowledge on resuscitation and early referral.
They were provided logbook to record every new-born that will be resuscitated, and this logbook will be collected by MCAI staff every month for reporting.

Methodology:
Pre-test was conducted to enable the facilitators know the knowledge of those skilled birth attendants on resuscitation, how to identify some critical illness in new-born, pathway for urgent referral and how to record in the logbook.

On the overall, for Grand Gedeh County the pre-test result was 87% and Sinoe County was 83% as per their knowledge assessment.
The training was interactive discussion by using the flit chart, logbook, and the lesson was from the new MCAI neonatal care handbook.

Materials:
The materials are resuscitation platform, logbook, MCAI Neonatal care training manual, poster chart.

TRAINING OUTCOME:

Finally, they all have knowledge on usage of the resuscitation platform, how to identify early critical illness in newborn, early referral, and proper recording of resuscitated baby's record.

End of Training Evaluation
There was time for questions and answers. The training was done in each facility.
There were post tests conducted after the training and the overall average for Grand Gedeh was 94% and for Sinoe was 91%.
Finally, they all have knowledge on usage of the resuscitation platform, how to identify early critical illness in newborn early referral and proper recording.

Trainers: – GRAND GEDEH

1	Christina Nyenabo – Qualified Neonatal Clinician, MTMH NICU Supervisor
2	Emmanuel Cole – MTMH Biomedical Technician
3	Matilda Belly – County Reproductive Health Supervisor

	Qualification	**Facility**	**Pre-Test Score**	**Post Test Score**	**Knowledge Gained**
1	RM	KHC	90	94	Exec
2	RM	KHC	88	92	Good
3	RM	KHC	85	90	Good
4	RM	KHC	79	86	Good
5	RM	KHC	83	90	Good
6	RM	KHC	79	86	Good
7	RM	KHC	84	86	Good
8	DHO/ PA	KHC	93	96	Exec
9	RM	GHC	85	89	Good
10	RM	GHC	87	90	Good
11	RM	GHC	80	87	Good
12	RM	GHC	81	92	Good
13	PA	GHC	90	97	Exec
14	RM	GHC	89	91	Good
15	RM	Toe Town Clinic	78	88	Good
16	RM	Town Town Clinic	82	89	Good
17	PA	Town Town Clinic	93	96	Exec
18	RM	Toe Town Clinic	91	94	Exec
19	RM	P/Pennonken	80	92	Good
20	RM	P/Pennonken	90	96	Exec
21	RM	P/Pennonken	88	91	Good
22	RM	P/Pennonken	79	89	Good
23	RM	P/Pennonken	88	93	Good
24	RM	PTP	90	94	Exec
25	RM	PTP	88	93	Good
26	RM	PTP	78	89	Good
27	RN	PTP	81	88	Good
28	RN	PTP	84	91	Good
29	RN	PTP	88	90	Good
30	RM	JArzon	78	85	Good
31	RM	JArzon	78	89	Good
32	RN	JArzon	82	87	Good
33	RN	JArzon	81	89	Good
34	RN	JArzon	85	90	Good

Anonymised participants' listing, pre and post test results.

Trainers: – SINOE COUNTY

1	Dehcontee Knowlden – FJ Grante Neonatal Clinician
2	Isatu Kamara – FJ Grante Neonatal Clinician
3	Dr. Kesselebah Goyah – OB GYN Specialist- MD

Anonymised participants listing, pre and post test results.

No	Qualification	Facility	Pre-Test Score	Post Test Score	Knowledge Gained
1	RM	Butaw	92	96	Excellent
2	RM	Butaw	87	90	Good
3	RM	Butaw	80	89	Good
4	RM	Butaw	81	90	Good
5	RN	Wiah	86	92	Good
6	RM	Wiah	91	96	Exec
7	RM	Wiah	89	91	Good
8	RM	Wiah	83	91	Good
9	RN	Wiah	81	90	Good
10	RN	Wiah	87	89	Good
11	RM	RTM	84	95	Good
12	RM	RTM	88	91	Good
13	RN	RTM	84	91	Good
14	RN	RTM	78	90	Good
15	Nurse AID	RTM	77	83	Good
16	RM	FJ Grant	89	92	Good
17	RM	FJ Grant	87	94	Good
18	RM	FJ Grant	89	93	Good
19	RM	FJ Grant	80	89	Good
20	RM	FJ Grant	85	90	Good
21	RN	FJ Grant	90	94	Excellent
22	OBC/RM	FJ Grant	91	97	Excellent
23	RN	FJ Grant	76	82	Good
24	RN	FJ Grant	80	90	Good
25	RN	FJ Grant	81	92	Good
26	RN	FJ Grant	80	91	Good
27	RN	FJ Grant	89	92	Good
28	RN	FJ Grant	80	86	Good
29	RN	FJ Grant	81	90	Good
30	RN	FJ Grant	78	89	Good
31	RN	FJ Grant	75	87	Good
32	RN	FJ Grant	79	88	Good
33	RN	FJ Grant	80	89	Good

Constraint(s):
Delay in transporting our materials due to limited vehicle in Grand Gedeh County.

Recommendation(s):
Vehicle be provided, as by FJ Grant Hospital, to transport materials and staff for effective and timely work.

LOG BOOK FOR RESUSCITATION OF THE NEWBORN BY ALL STAFF ATTENDING DELIVERIES IN THE FACILITY

NAME OF RESUSCITATOR: Marington Gaely
DATE OF BIRTH: July 13, 2024
PATIENT'S HOSPITAL NUMBER: 16-54-
BIRTH WEIGHT: 2.4kg
HOSPITAL OR FACILITY: C.B. Dunbar Hosp
NAME OF MOTHER: [redacted]
DESCRIBE ANY MATERNAL PROBLEMS DURING LABOUR: Primi gravida
ANY EQUIPMENT PROBLEMS: Ø
DESCRIBE STATE OF BABY AT BIRTH: Breathing? Normal or gasping – Gasping
Heart rate > 100 or < 100: < 100
APGAR SCORE AT 1 MINUTE: 5
APGAR SCORE AT 5 MINUTES: 7
WAS NEONATAL RESUS. REQUIRED? Yes
IF RESUSCITATED WHAT WAS DONE?
BAG AND MASK: ✓
CHEST COMPRESSIONS?
DRUGS?
DESCRIBE IN DETAIL WHAT HAPPENED DURING RESUSCITATION: At 1:23pm, pt gave birth to alive male infant 2 g apgar in one min Neonate was stimulated but still at cyanotic breathing observed then bag and mask ventilation was done for 2 mins and baby started breathing and crying. Pt immediate neo born care were given
DID THE BABY SURVIVE? IF NOT DESCRIBE WHAT HAPPENED: Survive.

LEFT: Neonatal resuscitation platform suitable for low resource tropical settings
RIGHT: Logbook entry of completed neonatal resuscitation using neonatal platform

TRAINING PHOTOS

A. GRAND GEDEH

TRAINING PHOTOS

B. SINOE COUNTY









Appendix 3: Anaesthetic report Liberia:

Trainer: Dr Diane Watson, MCAI volunteer consultant obstetric anaesthetist UK

Anaesthetists are vital to work as part of multidisciplinary teams in emergency obstetric care. As part of the task-sharing programme, anaesthetists were identified in the hospitals where obstetric clinicians are based in remote areas. These anaesthetists have an onerous workload and often are the only anaesthetist in the hospital, especially overnight and at weekends or holidays.

At this time, 4 of these nurse anaesthetists are recognised as being affiliated with MCAI and receive a modest financial incentive every month ($50).. They are Ramsey B Zeon Jnr (Martha Tubman Memorial Hospital, Grand Gedeh), Targen Nuahn (FJ Grant Hospital, Sinoe), Moses Togbah (Fishtown Hospital River Gee) and Betty Saylee (Sinje CEmOC clinic Grand Cape Mount).

These nurse anaesthetists are given professional development sessions via internet once a week with a retired UK anaesthetist. However, the anaesthetists are often unable to attend due to their clinical commitments. The internet signals are often poor and intermittent in these remote areas, so it is not possible to have much interaction during these sessions. The material used for these sessions is e-mailed or sent via WhatsApp to each anaesthetist after the session.

These sessions are also times when concerns are raised. These are usually because of the severe morbidity or mortality of a patient.
These disasters relate to:

1 Delay in transport of patients to hospital. An example of this is nurses from a community health centre being unable to contact ambulance control.
2 Lack of equipment in ambulances, including essential drugs such as oxygen
3 Lack of essential anaesthetic and emergency drugs in the hospitals and delays to emergency surgery because relatives have to pay for and obtain these from the local pharmacy
4 Lack of equipment, or non-functioning equipment in the operating theatre
5 Lack of blood for emergency transfusion

Despite the many constraints, these nurse anaesthetists are highly motivated, work well in multidisciplinary teams, and are skilled in resuscitating obstetric women and assisting in management of critically ill adults and children.

Qualified nurse anaesthetists often leave the public sector to work in private hospitals, and some give up the profession and find other work that is less onerous and pays more.

Background
An assessment of Anaesthesia Capacity in Liberia in 2019 using the World Federation of Societies of Anaesthesiologists (WFSA) Anaesthesia Facility Assessment Tool (AFAT) revealed critical gaps in anaesthesia and surgical capacity in Liberia.

Physician anaesthesiologist and nurse anaesthetist densities were 0.02 and 1.56 per 100 000 population, respectively. The WFSA recommend 10 anaesthesiology doctors per 100 000 population, showing the number of anaesthetists in Liberia is critically low even if nurse anaesthetists are included, which is also the case in 69 other countries in Africa.

Emergency funds needed for nurse anaesthetists to work in partnership with obstetric clinicians.

Please click here for the Concept note MCAI submitted to MOH November 2020 for Emergency funding needed for nurse anaesthetists to work in partnership with obstetric task-sharing in Liberia.

Click here for request for additional training to obtain more nurse anaesthetists to work as part of task-sharing in rural hospitals sent in 2020 to MOH regarding nurse anaesthetists.

Reference

Odinkemelu, Didi S. MD[*]; Sonah, Aaron K. RN, MPH[†]; Nsereko, Etienne T. RN, MSc[‡]; Dahn, Bernice T. MD, MPH[§]; Martin, Marie H. PhD, MEd[‖]; Moon, Troy D. MD, MPH[‖]; Niconchuk, Jonathan A. MD[¶]; Walters, Camila B. MD[¶]; Kynes, J. Matthew MD[¶] An Assessment of Anesthesia Capacity in Liberia: Opportunities for Rebuilding Post-Ebola.
https://resources.wfsahq.org/wp-content/uploads/An_Assessment_of_Anesthesia_Capacity_in_Liberia_.128-1.pdf