Reducing maternal, neonatal, and child mortality and improving quality of health care through a national task-shifting program in public hospitals in Liberia.

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Abstract

Background: One of the main factors contributing to the high hospital-based maternal, neonatal, and child mortality in low-and -middle income countries is the shortage of doctors to deal with emergencies. This paper describes training programmes, conducted over 10 years, aiming to enhance the skills of midwives and nurses to provide emergency, quality hospital-based care to pregnant women, newborn babies, children, and adolescents in rural Liberia.

Method: A task-shifting partnership between the Liberian Ministry of Health, WHO Liberia, UNFPA and UNICEF Liberia and the Scottish charity, Maternal and Childhealth Advocacy

International (MCAI) was agreed in 2013. Later partners included Irish Aid and the University of Edinburgh. Health teams from rural areas of Liberia selected experienced midwives and nurses for advanced training. Obstetric trainees underwent a 3-year programme, which included operative obstetrics. The training programmes for neonatal and paediatric clinicians were 2 years and 2.4 years respectively. Training was by a combination of apprenticeship-based training and distance learning and was delivered by Liberian specialists and international obstetricians, neonatal practitioners, and paediatricians. Trainee competence was established by continuous assessment, oral and written clinical examinations. The programme also required upgrading of hospital buildings and supplies of essential equipment and drugs.

Results: 28 obstetric clinicians, 16 neonatal clinicians and 11 paediatric clinicians have been trained and are qualified and working in 9 hospitals in rural areas of Liberia. Obstetric clinicians have demonstrated that they can competently manage obstetric emergencies and perform abdominal surgery including the surgical management of ruptured ectopic pregnancy and caesarean sections. Neonatal clinicians can resuscitate and care for sick and premature babies to World Health Organisation Special Care Level 2. Paediatric clinicians can manage the common paediatric emergencies that contribute to high mortality, and paediatric mortality has reduced from 9.5% at Phebe Hospital before the training to 4.2% in the final year of training.

Conclusion: This task sharing programme has shown that midwives and nurses can have comprehensive training to provide safe and effective hospital care to pregnant women, neonates, and children. This approach is one solution to the common health workforce

problem in low resource and conflict settings and has the potential to be implemented in other countries.

Keywords: Task-shifting. Hospital maternal, neonatal, child health. Liberia

Background:

According to a recent USAID report from August 2023, the current Maternal Mortality Rate in Liberia continues to remain extremely high at 742 deaths per 100,000 births (CI: 485-1,000) – Demographic and Health Survey (DHS) 2019/20. Neonatal mortality is 31/1000 live births (almost certainly under-reported), under 5-year mortality 78/ 1000 and paediatric mortality rates are high but unrecorded. [1]

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 complications. This includes preventable maternal deaths, obstetric fistula following obstructed labour, and brain damage in children where neonatal resuscitation has been delayed or performed incorrectly.

In Liberia, the density of medical doctors (per 10,000 of the population) has improved by an increase of 1.5/10,000 population from 0.33 in 2004 to 1.8 in 2022. Globally the density of medical doctors is 17.2/10,000 of the population. In Africa as a whole, it is 2.6/10,000 which shows how poor Liberia is with respect to the availability of physicians [2]. For this reason alone, the recruitment of physicians by well-resourced countries, such as the USA, is inappropriate [3].

Emergency hospital obstetric, neonatal, and paediatric care frequently involves long periods overnight where doctors must work without sleep and when mistakes made due to tiredness, can be fatal. Such pressures can usually be tolerated where there are enough well-trained doctors to rotate and 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 hospitals in rural areas, or undertaking private health work where overnight, front-line clinical care is minimal. Some doctors accept offers of desk-based jobs from international organizations.

The loss of doctors from front-line clinical care especially in rural areas makes the situation worse. It leads to a lack of quality care for patients and reduced opportunities for junior doctors to become trained by senior experienced specialists in advanced obstetric, neonatal, and paediatric care. The few trainers available usually prefer to remain in cities. 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.

The locally documented numbers of doctors in Liberia in 2016 are described here (Link1). There continues to be a severe shortage of doctors in Liberia, particularly in hospitals in rural areas where the workload is often intolerable.

WHO in its Health Workforce Overview [4] estimates a projected shortfall of 10 million health workers by 2030, mostly in low- and lower-middle income countries

Where there is shortage of doctors, other cadres of health workers have been appropriately trained in other countries to assist doctors as part of hospital teams to treat serious medical and surgical problems. [5, 6, 7] and link here (Link 2).

Task-shifting is advocated by WHO [5] as follows *The WHO recognizes task sharing as a promising strategy for addressing the critical lack of health care workers to provide reproductive, maternal and newborn care in low-income countries. Task sharing is envisioned to create a more rational distribution of tasks and responsibilities among cadres of health workers to improve access and cost-effectiveness.*

Many hospital deaths relate to four 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 4) subsequent delay in providing appropriate emergency treatment and management.

The anonymized case study provided within the logbook of a trainee obstetric clinician below illustrates the fatal consequences of delay. See Box 1 (Link 3)

Registered midwives are present in all countries, including those with the smallest number of doctors. Midwives, unlike most doctors, are rooted in their communities and are extremely unlikely to migrate to seek better pay and conditions. 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 eclampsia. 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 hospitals in rural areas.

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-shifting 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-shifting approach that encompasses both advanced obstetric and advanced neonatal hospital care, can be particularly effective. Integrating obstetric, neonatal, and paediatric care within and between hospitals, clinics, and the community is also important.

Other steps to enhance safer care in difficult-to-reach communities are reduction of home births, better roads and ambulance services, better communication with communities concerning the dangers of delay, and establishment of Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) centres in high population, remote areas.

Program description

In 2013 MCAI began a series of task-shifting projects aimed at reducing the extremely high neonatal and maternal mortality rates in Liberia. This included the training of 55 obstetric, neonatal, and paediatric clinicians, the undertaking of obstetric outreach antenatal clinics (Link 4), nurse anaesthetist mentorship with efforts to recruit more anaesthetists (Link5), and recruitment of mothers during labour to work with midwives, obstetric and neonatal clinicians, and doctors to enhance the detection of fetal heart rate changes indicating possible birth asphyxia (link here to publication) (Link 6). [8]

A task-shifting partnership, operating under a Memorandum of Understanding between the Liberian Ministry of Health, WHO Liberia, UNFPA Liberia, UNICEF Liberia and the Scottish charity, MCAI, was agreed in 2013. Subsequently in 2017, WHO Liberia with a grant from Irish Aid, undertook an independent combined international and national evaluation of how pilot task sharing programs underway in Liberia, especially in obstetrics and neonatal care, were working, and might be enhanced. Two reports (link here to word version (Link 7) and here to PowerPoint (Link 8)) strongly recommended that task-shifting should be strengthened and spread throughout Liberia, especially in rural areas.

Critical in a low resource country is support for the work force in the Liberian National Public Health Service (NHS). Unfortunately, private practice in Liberia has increased with more doctors involved in this form of care despite the continued and worsened poverty in the country. Adequate salaries for midwives and nurses who are functioning as obstetric, neonatal, and paediatric clinicians are needed urgently. For more information see link to barriers. (Link 9).

Potential trainee obstetric, neonatal, and paediatric hospital clinicians have been 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 category of clinician. 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 deliver advanced hospital care for infants, children and adolescents returned to work in their local public hospitals in rural areas.

Funding for the salaries of clinicians undergoing training was provided by the County Health Teams who were already covering the trainees' basic salaries as midwives or nurses (around

250 USD per month). During their training, MCAI supplemented their income by a 150 USD educational incentive every month. The intention was that the MOH would enhance their salaries after qualification (see link to barriers describing this problem) (Link 9).

All trainees, unless they originated from Bong County, were provided with secure accommodation close to their training hospitals. Training hospitals were CB Dunbar, CH Rennie and Redemption Hospitals for Obstetric Clinician training, and CB Dunbar neonatal unit for all neonatal clinician training. The newly renovated hospital paediatric unit and emergency room at Phebe Hospital was used for training the first cohort of paediatric clinicians.

The premise was that, following training, the clinicians would work in rural hospitals in the counties from which they had been seconded. Once they had successfully completed their training programs, qualified clinicians were granted a five-year license by the Ministry of Health to work either in their original county hospitals, or 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 higher concentration of doctors) or in private facilities.

The training programs adopted curricula on obstetrics (Link 10), neonatal (Link 11) and paediatrics (Link 12) hospital care. They were developed by MCAI with technical input from WHO and approved by the Partnership.

Training was predominantly apprenticeship based, involving, 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. Apprenticeship based training also involved handover meetings

198 (where trainees and qualified staff who had been on duty during the previous 24 hours discuss
199 the patients admitted for care), ward rounds, and case presentations alongside continued
200 supervision of the latest new admissions.

201 The training programs began within the apprenticeship based training with specific
202 foundation courses ; see links here: obstetrics (Link 13), neonatal (Link 14) and paediatric care
203 (Link 15) after successful completion of which, the trainees moved on to apprenticeship-
204 training.

205 The monitoring and evaluation of the three different clinician training programs followed the
206 same requirements: each trainee recorded all performed procedures and the outcome in a
207 paper and electronic logbook. Weekly examination results were also recorded.

208 Following a request from the Late Deputy Minister for Curative services, Dr. Saye Baawo (RIP),
209 and The Registrar of the Liberian Medical and Dental Council, Dr. Nyaquoi Kargbo, a 3-day
210 course (Link 16) in medical ethics and professional standards was undertaken by the
211 Partnership during 2015. A checklist (Link 17) for ethical systems to be developed for
212 healthcare in Liberia was presented to the MOH.

213 Please find links here for the one day professional and medical ethics courses undertaken by
214 obstetric plus neonatal,(Link 18) and paediatric clinician (Link 19) trainees at the onset of
215 every training course.

216 **Structure of the 3 training programs in hospital obstetrics, neonatal and paediatric care.**

217 There were many similar features concerning the 3 training programs. These similar features
218 are described first, and unique features of the individual programmes afterwards.

219 **Common to all 3 programs were as follows:**

Each trainee was given a computer tablet or laptop computer containing extensive E-libraries of relevant publications and >200 videos pertinent to low resource settings for training purposes and for the 3 specific groups: obstetrics, neonatal and paediatric care.

Each trainee was also provided with an electronic and hard copy of MCAI's handbooks on hospital care in low-resource settings, conflict and post conflict settings involving maternal, paediatric, and neonatal health care. Link here for details. (Link 20).

A total of additional 1,000 handbooks (250 of each of the above 4) have also been printed and distributed to other nurses, midwives, and doctors throughout Liberia.

Continuous educational assessment

All trainees were continuously assessed to ensure that they were competent, knowledgeable, and safe. Each trainee was required to pass an annual Objective Structured Clinical Examination (OSCE).

In addition to apprenticeship training, weekly distance-learning involving interactive tutorials were provided for all 3 trainee groups by MCAI volunteer international obstetricians and paediatricians, using Zoom meetings. This occurred before during and after the Covid pandemic. During some of these sessions, clinical case presentations and clinical audit were debated. Links to the content of these weekly trainings specific to obstetrics, (Link 21) neonatal (Link 22) and paediatric care year 1 (Link 23) and year 2 (Link 24) are available for view here.

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 tutors, on the topics on which they were taught the week before. The results of

each test were fed back to the trainees through international audio-visual conferencing and provided continuous evaluation while highlighting any areas where further training was needed. (see links containing details of the weekly training (Link 21) for the last cohort of 9 obstetric clinicians and also linked here one of the weekly examinations (Link 25) including answers expected.

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

In accordance with the WHO international evaluation, plans were prepared to institutionalise all three specialities of the National Task Sharing Programme within a Liberian University, to help provide a formal professional qualification, encouragement, and gratitude to these vital members of the health workforce, Please see link to "barriers" (Link 9) an account of problems achieving this. Plans are now underway to begin a part-time BSc course for each trainee within the University of Liberia and Tubman University (both are foremost national universities in Liberia).

Health System Strengthening to support the training programs.

For all 3 training programs, it was essential that all hospitals in which the trainees (and subsequently the licensed obstetric, neonatal, and paediatric clinicians) were based, were 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 were available.

Emergency equipment provision

Prior to the Ebola outbreak in 2014 an extension to the Emergency Room at Phebe Hospital as well as large amounts of anaesthetic and critical care equipment were provided for this hospital. MCAI also provided Phebe hospital with a large oxygen generator during the Ebola outbreak which provided cylinders for surrounding hospitals.

Figure 1

Legend to Figure 1 *Numbers in boxes relate to the hospitals or major Health Centres described below. The 13 Hospitals or CEmMNCH facilities are where trained obstetric, neonatal and paediatric clinicians are now working. 1) CB Dunbar Maternity Hospital; 2) Phebe Hospital; 3) Tellewoyan Hospital; 4) Martha Tubman Memorial Hospital; 5) FJ Grante Hospital; 6) Sinje CEmMCH; 7) Fishtown Hospital; 8) St Francis Hospital; 9) CH Rennie Hospital; 10) Saclapea CEmMCH; 11) Redemption Hospital: 12) Bong Mines Hospital; 13) J.J. Dossen Hospital.*

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.

Some of the most dangerous situations (see link to Barriers (Link 9)) that arose during the program over the last 4 years, related to the consequences of the delays caused by a nationwide lack of essential emergency drugs and supplies in all public hospitals in Liberia. This problem is particularly dangerous for a country where there is extreme poverty. It has been shown in a program of fetal monitoring by mothers in labour in a related manuscript to be an avoidable cause of many cases of severe birth asphyxia, including subsequent deaths [8].

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 avoidable maternal, neonatal and child deaths.

Please click here (Link 26) for emergency drug kits supplied to trainee obstetric and neonatal clinicians.

Please click here (Link 27) for emergency drugs provided monthly for trainee paediatric clinicians.

Table 1. Numbers of trained and qualified obstetric, neonatal, and paediatric clinicians.

	Obstetric trainees	Neonatal trainees	Paediatric trainees

Years	Number trained	Number trained	Number trained
2013-016	2		
2015-2019	9	4	
2018-2021	10	6	
2020-2024	9	8	12
Total trained	30*	18**	12***
Total working in Liberia	**28**	**16**	**11**

* One of the 1st two trained died 2 years after qualification. One did not reach required standards to qualify and returned to working as a Physician Associate.

** 2 trainees left the programme, one before completing to undertake a master's degree in The Netherlands and one to the USA after marriage.

*** Qualified in June 2024. One trainee did not reach the required standard, and is doing further training

Obstetric apprenticeship

The 3-year obstetric apprenticeship was supervised by 9 Liberian obstetricians, with extended visits from UK obstetricians to support the training. Link to trainers (link 28) Later, more experienced, qualified obstetric clinicians also contributed to training. The latter also helped to train qualified doctors who were interested in becoming involved in hospital obstetrics. 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 even complicated caesarean sections, independently.

Later in the obstetric clinician training program, an apprenticeship-based training in obstetric ultrasound scanning during labour and delivery and subsequently for obstetric outreach work was also provided (by OD).

Nine maternity units have been renovated and equipped and upgraded delivery rooms and operating theatres have received essential equipment (for examples ultrasound scanners, vacuum delivery systems, caesarean section and laparotomy instruments, head torches and doppler probes). These units are numbers 1,3,4,5,6,9,10,11,12 in Figure 1

Please click **here** (link 29) for medical equipment provided for obstetric and neonatal units.

History of the training of obstetric clinicians

The first two trainee obstetric clinicians (HG and NL) began their training at CB Dunbar Hospital in October 2013. The Partnership viewed this initial phase of the project as a pilot, 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.

The Ebola outbreak disrupted the supportive training from international experts, but HG and NL continued to work throughout the Ebola outbreak, providing much needed support to Dr. Dolo and his team (See Figure 2).

Figure 2. 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 HG and NL 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.

From the start of the apprenticeship part of their training in October 2013 until March 2015, both trainees helped 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). (Link 30) 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.

Because of the encouraging results of the pilot phase, and following an international review in April 2019 by WHO funded by Irish Aid (click here for PowerPoint (Link 8) and PDF/written versions (Link 7)), 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 and 2 were physician assistants with prior experience in hospital-based midwifery.

By February 2017, all trainees had passed their end of 2nd year OSCE and all performed well in their weekly exams. They began their 3rd year of training in 4 rural hospitals. Link to Map (Link 31). 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.

Please click here for the initial Foundation course (Link 13) focused on the basics of advanced obstetric care, including surgical skills, obstetric anatomy, obstetric ultrasound, and post-operative care.

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 9 trainees in the 4 rural hospitals in which they were based.

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 serious complications of pregnancy and delivery.

Despite additional training, 1 of the 9 continued to fail final assessments. Therefore only 8 of this group of 9 trainees were successfully registered with the Liberian Medical and Dental Council LMDC. The one who failed continued to work as a physician assistant.

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 trainee obstetric clinicians (out of 26 candidates), specifically selected from the most remote 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 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 HG tragically died RIP). Thus 28 obstetric clinicians 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. See anonymised link to data on all 30 obstetric clinicians trained. (Link 32)

And link here to trainers (Link 28) of obstetric clinicians.

Throughout and when possible MCAI has provided equipment, emergency drugs, and supplies to help enable safe obstetric 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. (Link 33). National and international trainers

review these forms on a regular basis with the trainee involved and discuss any pertinent issues.

An account of the clinical Experiences of trainee obstetric clinicians (Link 34) is recorded here.

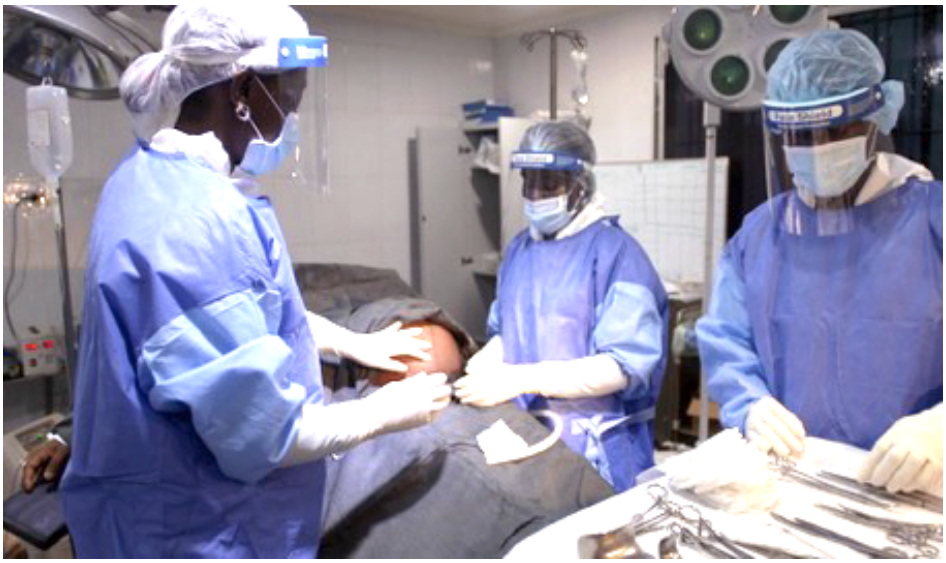

Figure 4. Two obstetric clinicians undertaking an emergency Caesarean section at Redemption Hospital (one of the two training hospitals for obstetric clinicians) in Liberia.

The progress of every individual trainee was monitored by the recording of each procedure performed and the outcomes during their training, in both a paper and electronic logbook. Click here for the obstetric clinician logbook. (Link 35). See an anonymised example of a completed logbook (Link 36) by one of the obstetric clinicians.

Click here (Link 37) for Table of obstetric emergency hospital care in 6 CEmONC facilities 2021-2022. These data were obtained from the theatre records book only and individual cases have not been further investigated. The purpose of this Table is to give an overview of the emergency obstetric surgical procedures performed. Focus is on the lead surgeon for the procedure and the team is separated into whether the surgery was undertaken by a doctor

or an obstetric clinician to demonstrate the impact of the task-shifting programme between 2021 and 2022.

Every trainee obstetric clinician undertook a weekly examination covering subjects taught by international experts in the preceding week. (see details of the weekly training (Link 21) for the last cohort of 9 obstetric clinicians and also linked here one of the weekly examinations; this on the subject of caesarean section) (Link 25) .

At the end of the 3 years a final examination is undertaken. Click here (Link 38) for Results of the final examination for latest group of 9 obstetric clinicians September 2023.

An evaluation form (Link 39) on each trainee undertaken by the Liberian consultant obstetricians who supervised the apprenticeship part of their training is seen here.

Obstetric outreach clinic program

Since 2019, qualified obstetric clinicians have travelled monthly to obstetric outreach clinics (Link 4) in 4 rural counties (Grand Gedeh, River Gee, River Cess, Sinoe) to identify and give advice to women with high-risk pregnancies. Those seen and needing urgent admission were immediately transported to hospital.

Fetal heart rate monitoring by mothers in labour

An extension of the task-shifting program has included the involvement of mothers (Link 6) 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 life-threatening fetal distress and preventing birth asphyxia. Initial results were published in March 2020 from 2 hospitals (one of which was

destroyed subsequently by fire) where 461 pregnant women had monitored their unborn babies in this way. 28 mothers (6.1%) reported changes in fetal heart rate during labour [8].

Subsequently, a total of 6582 participating mothers attending 4 rural hospitals between July 2017 and December 2022 (including one of the two hospitals above) have been enrolled in a continuing program to help midwives and doctors to identify changes in fetal heart rates during labour (results currently being prepared for a partner publication).

Specific training of neonatal clinicians

The 2-year neonatal apprenticeship training was supervised by an international advanced neonatal nurse practitioner, and a Liberian paediatrician, with regular visits (1 to 6 months in duration) from international experienced advanced nurse practitioners and paediatricians. Link to trainers.(link 28)

16 experienced nurses have completed 2-year courses of training in advanced hospital neonatal intensive care (including nasal Continuous Positive Airway Pressure (CPAP) but not intubation and assisted ventilation following intubation) and are currently leading care in 9 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. However, as no surgery is involved, the training program could be completed in two years.

Monitoring and evaluation required that each trainee must record all performed procedures and the outcome in a paper and electronic neonatal clinician logbook . (Link 40).

Weekly examination results were recorded. (Link 41).

The monitoring of neonatal mortality rates (Link 42) in the catchment area of CB Dunbar and Martha Tubman Memorial Hospitals was undertaken.

Click here (Link 43) for the final examination results from September 2022 for the latest 8 qualified neonatal clinicians.

Here is a link providing details of equipment provided for each newly renovated NICU. (Link 44)

Here is described 1) the first developed neonatal unit at CB Dunbar Hospital in Bong County which became the main training facility and 2) the neonatal unit at Martha Tubman Memorial Hospital in Grand Gedeh County. (Link 45).

Prior to their establishment, initially in CB Dunbar Hospital, there were no Neonatal Intensive Casre Units (NICU) in the 9 rural counties in Liberia where these are currently based.

Nine neonatal intensive care units have been completed (see Figure 1 **MAP** showing hospitals) (Link 31).

1. CB Dunbar Hospital, Bong County (Funded by MCAI and UNFPA)
2. Phebe Hospital, Bong County (renovated and equipped by MCAI with Irish Aid Funding)
3. Tellewoyan hospital, Lofa County (renovated and equipped by MCAI with Irish Aid Funding)
4. 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)
5. FJ Grant Hospital in Sinoe County. Equipment was funded by MCAI and renovation by the DAK Foundation in Australia.

6. 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.
7. Fishtown Hospital in Rivergee County (Funded by Irish Aid)
8. St. Francis Hospital in Rivercess County (Funded by Irish Aid
9. CH Rennie Hospital, Margibi County (Funded by UNFPA)

A typical clinical experience (Link 46) of trainee neonatal clinicians is recorded here**.**

By June 2024, 16 senior nurses/midwives have undergone 2 years of training. See anonymised link to data on all 16 neonatal clinicians trained (Link 47). And link here to trainers of neonatal clinicians. (Link 28).

Training in neonatal resuscitation

Neonatal clinicians were trained to provide advanced resuscitation of the newborn infant who does not breathe at birth. They also attended every birth in the hospital where fetal distress had been identified. With funding from Irish Aid, qualified neonatal clinicians have also provided neonatal resuscitation training to birth attendants in Grand Gedeh and Sinoe counties with imminent plans to also do this training in River Gee and River Cess Counties.

The training of the first 12 paediatric clinicians in Phebe Hospital

The 2 -year 6 month paediatric training has been undertaken by a Liberian paediatrician and a full time international advanced nurse practitioner (Link 48) who had worked for many years with Medicine Sans Frontiers in Nigeria. The program was led by UK paediatricians Dr Sarah Band and Professor David Southall. Link to trainers (link 28).

This new component of the Liberian National task sharing program complemented and integrated with the existing task-shifting programs in advanced obstetric and neonatal care. It concentrated on the training of 12 senior nurses recruited from 5 rural counties (Bong, Grand Gedeh, River Cess, River Gee, and Sinoe) including 2 nurses from the training hospital at Phebe. The training lasted for 2 years and 4 months and was funded by Irish Aid, undertaken by MCAI, and completed by the end of May 2024.

Currently in rural Liberia, a large majority of children who require hospital care 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 appropriate to their ages resulting in delays and complications.

Training occurred in the renovated children's unit funded by Irish Aid through MCAI in the county hospital in Bong (Phebe Hospital). Click here for pictures prior to renovation (Link 49) and here for post renovation. (Link 50)

Newly renovated paediatric departments in 4 county hospitals were developed by MCAI, MOH and funded by Irish Aid, where 8 of the trained paediatric clinicians are deployed. Hospital numbers 4,5,7,8. See Figure 1 Map. (Link 31)

New equipment, including nasal CPAP, oxygen concentrators and Intravenous infusion controllers funded by Irish Aid designed to improve the healthcare of very ill children was procured by MCAI for the new training unit in Phebe Hospital. A new emergency room to

receive, assess and manage infants, children and adolescents was simultaneously 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, were published. The training curriculum is based on these 2 manuals. Click here for Handbook 1 (Link 51) and here for Handbook 2.(Link 52).

Needs assessment before paediatric training:

To assess the need, and to inform the curriculum, paediatric mortality data were collected from 3 rural hospitals in Liberia (including Phebe Hospital) before this apprenticeship training was started. The themes highlighted helped to improve the care of paediatric patients across the country as well as guide key points for education and teaching.

Results of needs assessment. Please link here for an analysis of data on mortality prior to paediatric clinician training.(Link 53). In Phebe Hospital the mortality rate was 9.5%.

Please **click here** (Link 54) to read an overview of Paediatric Admissions at Phebe Hospital after the onset of training in August 2021-July 2022.

Click here (Link 55) for overview of Age of Paediatric Admissions and outcome at Phebe Hospital after the onset of training Aug 2022-July 2023

Paediatric admitted mortality rate reduced from a baseline of 9.5% before the training course began to 4.2% in the final year of training in Phebe Hospital, where the paediatric trainees and international trainer were based.

Paediatric Training

Eleven of the first 12 trainee paediatric clinicians (Link 56) at Phebe Hospital qualified in June 2024 and soon will be working in paediatric wards at Martha Tubman Memorial, Fishtown, St Francis, FJ Grant, CB Dunbar and Phebe Hospitals. 1,2,,4,5,7,8 see figure1 (Link 31).

The lead international apprenticeship based trainer is Abdulkadir Hassan seen here undertaking a ward round (Link 57) in the new paediatric wards at Phebe Hospital.

Please click here for the paediatric clinician logbook (Link 58) used by paediatric clinicians to document the patients they have managed during their training

Weekly tutorials (via Zoom) were performed by senior international volunteer experts in hospital paediatrics who all had experience in caring for children in low resource countries. They prepared and marked the weekly written examinations. The paediatric clinician training timetables for year 1 (Link 23) and for year 2 (Link 24) are available here.

The summary of weekly examinations undertaken by each of the 12 paediatric clinician trainees are also available for year 1 (Link 59) and for year 2.(Link 60)

Results of the end of year 1 examination for the paediatric clinicians are available here. (Link 61).

Results of the final examination paper undertaken by the first 12 paediatric clinicians are available here. (Link 62) For a letter to all trainees regarding final revision points following the final examination: click here. (Link 63).

By June 2024, 12 senior nurses have undergone 27 months of training. See anonymised link to data on all 12 paediatric clinicians trained. (Link 64). And link here to trainers of paediatric clinicians. (Link 28)

Prescribing guidelines (click here) (Link 65) for paediatric clinicians have been developed and provided once they had qualified and began work in their local hospitals.

Enhanced monitoring of maternal, newborn and child deaths in Liberia.

MCAI working in partnership with the Liberian MOH and through an existing Irish Aid grant, funded the salary of the convenor of the MNDSR (Maternal, Neonatal Death Surveillance Review) program (Suena Sambola) currently now based in and funded by the Ministry of Health with financial communication support from MCAI.

MCAI are requesting that this program work with the Family Health Division 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 Registered Nurse) 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 child abuse in the 13 counties where trainees are placed, with a view to expanding the data collection with the help of WHO and UNICEF, to establish a data monitoring system for child and adolescent health throughout Liberia, which currently does not exist.

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

In an integrated approach to provide the continuum of care, 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) see Figure 1. (Link 31). An additional 4 platforms have

been established in each of the hospitals (CEmONC facilities) in the 4 designated counties. Each platform is accompanied by a bag and mask inflation and manual suction systems. Results from 2 of the 4 county clinics are described here. (Link 66)

The 18 clinics were selected by virtue of their large number of births and long distances from the county hospital.

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

Local MCAI logisticians were responsible for the data collection including logbooks kept in each facility and scanned and returned to MCAI for analysis.

Additional training for nurse anaesthetists working closely as part of the national task-shifting program with obstetric, neonatal, and paediatric clinicians in Liberia.

Please click here (Link 67) for links describing the vital role of nurse anaesthetists in task-shifting in Liberia including MCAI's attempts (concept note (Link 68) and new team training programs (Link 69) to improve the supply of nurse anaesthetists to hospitals in rural areas (see Barriers (Link 9).

Discussion and Conclusions

This report describes the development of a task sharing program for pregnant women, newborn babies and children in hospitals in Liberia a post-conflict, low -resource country.

This development is also relevant to addressing situations involving internally displaced and refugee populations (such as those currently in Sudan, Tigray, Afghanistan, Israel (Gaza),

Afghanistan and Yemen) where there are few doctors and damaged or absent hospitals and where such essential emergency healthcare can be lifesaving.

The program has shown that midwives and nurses can be trained to increase their knowledge and practical skills, to a level at which they can provide safe emergency care to save lives. The clinicians selected have developed a remarkable ability to take on new challenges, learn from experience, and foster teamwork in their hospitals.

As the program progressed, it became apparent that there were additional training needs which would make the system safer. Examples were training for nurse anaesthetists, and ultrasound training for midwives. Flexibility was therefore essential.

Regular and frequent contact between the international trainers and the trainees, as well as with the local trainers, enabled adjustments to the curriculum to be made as needed. We are now confident that the topics covered in the training plans, in conjunction with the handbooks and video libraries, provide the theory for midwives and nurses to practise emergency care safely in low resource and emergency settings.

The program is not intended to replace doctors with nurses, or to provide long term medical care in communities. It is intended to work with other clinicians to strengthen the emergency care normally offered in hospitals to pregnant women babies and children, and to provide a stable trained workforce in places where health systems are at their most precarious.

The biggest challenges have come not from trainee problems with learning, or developing new skills, but from weaknesses in the health system, such as lack of equipment, drug stockouts and unsuitable or unsafe hospital buildings. It is essential therefore that task sharing is accompanied by health system strengthening supported by Ministries of Health.

Good quality healthcare, even in the most resource limited settings, is vital although difficult to measure. Inclusion of ethics days, child protection training, and emphasis on communication with families in all the teaching, contributed to this. This program promoted quality, equity, dignity and evidence-based practices, which are in line with the values in WHO's Quality of Care network. [9].

Abbreviations: MCAI. Maternal and Childhealth Advocacy International

WHO. World Health Organisation

UNFPA. United Nations Population Fund

UNICEF. United Nations Children's Emergency Fund

USAID. United States Agency for International Development

CEmONC. Comprehensive Emergency Obstetric and Newborn Care

MOH. Ministry of Health

OSCE. Objective Structured Clinical Examination

LMDC. Liberian Medical and Dental Council

CPAP. Continuous Positive Airway Pressure

NICU. Neonatal Intensive care Unit

BEmONC. Basic Emergency Obstetric and Neonatal Care

MNDSR. Maternal Neonatal Death Service Review

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Acknowledgments

The authors would like to acknowledge the trainers, National and International, for all three programmes, Link to trainers. Also the Liberian midwives and nurses who have trained as obstetric, neonatal and paediatric clinicians, names of all 55 trained clinicians and who continue to undertake invaluable advanced hospital work for mothers babies and children.