Health system improvements combined with task sharing resulting in major reductions of intrapartum stillbirths, neonatal deaths, maternal deaths and consequences of birth asphyxia in 4 public hospitals in Liberia

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MCAI working in partnership with the Ministry of Health in Liberia and in collaboration with the organisations below.

Manifestations and consequences of Birth Asphyxia (BA)

Birth Asphyxia is a complex condition resulting primarily from impaired placental function and obstetric complications before and during labour

It can result in 1) death antepartum before arriving in hospital care (termed here Intra Uterine Fetal Death IUFD), 2) death during labour and delivery (termed here Intra Partum Stillbirth IPS) and 3) death in the neonatal period (especially in the first week of life).

It can also present with reduced fetal growth and movements, with changes in fetal heart rate (as identifiable using the WHO partograph), with inability to breathe adequately at birth (requiring resuscitation of the newborn), and with varying degrees of neurodevelopmental impairment in the neonatal period and in later infancy and childhood.

It represents a major cause of death and developmental impairment, especially in low-income countries.

It has tragic consequences for mothers and their families.

Details of heath system improvements including those related to task sharing in Liberia (one of the poorest countries in the world). 1 Workforce

- For 10 years a program to reduce extremely high maternal and neonatal deaths in public rural hospitals in Liberia has included the involvement of mothers working in partnership with midwives, nurses and doctors to improve the detection of life-threatening fetal distress during labour in hospital and to provide advanced care of pregnant women and newborn infants.

- A total of 6398 unselected mothers attending 4 hospitals since 2016 have been enrolled in a continuing program to help midwives and doctors to identify changes in fetal heart rates during labour (see below for details)
- In parallel with this new form of task sharing, 28 experienced midwives (obstetric clinicians) have received 3 years training in advanced obstetric care including major surgery such as Caesarean Section and vacuum delivery and are currently working in 9 hospitals and two comprehensive health centres including the 4 described in this report. They have received special training in obstetric ultrasound both during labour and in pregnancy.
- An additional 18 experienced nurses (neonatal clinicians) have received 2 years training in advanced neonatal intensive care (including nasal CPAP but not intubation and assisted ventilation through intubation) and are currently leading care in 7 neonatal units established over the last 6 years.
- All obstetric and neonatal clinicians have been trained to provide advanced resuscitation of the newborn infant who does not breathe at birth (a major feature of BA).
- 12 senior nurses are undergoing 2-year training in advanced paediatric hospital care

Details of heath system improvements including those related to task sharing in Liberia. 2 Hospital developments

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

- 8 maternity units have received essential equipment (for examples ultrasound scanners, vacuum systems, Caesarean section instruments, head torches and doppler probes) and upgrading of operating theatres and labour wards

- 1 paediatric unit has been completely renovated including an emergency room for children

Details of health system improvements, including those related to task sharing in Liberia 3. Emergency drugs and supplies for obstetric, neonatal and paediatric hospital care

One of the findings in the program described below 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 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 also extreme poverty. It has been shown in this current program to be an avoidable cause of several cases of severe birth asphyxia, including subsequent deaths.

With donor support, MCAI has been trying to compensate for the stock out of emergency drugs and supplies but inevitably, given the magnitude of need, has not always been able to prevent delays in emergency treatment, some of which have caused maternal and neonatal deaths

Summary of the fetal monitoring by mothers during labour

- In 4 the public hospitals all pregnant mothers arriving in labour are enrolled after consent
- Mothers are taught by volunteer nurses (nurse aids) in how to detect their unborn babies' heart rates using a battery-operated ultrasound probe
- Nurse aids work a shift system (3 in each hospital over a 24-hour system) aiming to provide training for every mother admitted
- Mothers are asked to monitor their babies **immediately following the end of every uterine contraction** in the latent, active and second stages of labour. If they need help, usually because of pain and tiredness, midwives or obstetric clinicians take over. The form used is provided below
- Data are entered into a password protected Google spread sheet
- A senior Liberian nurse supervises the program ensuring forms, batteries and working doppler probes are always available.
- Neonatal clinicians are contacted whenever a newborn baby is considered to be at risk of needing resuscitation and then care for all those admitted to the neonatal unit in each hospital.

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Forms used to document FHR during each labour

FETAL MONITORING PROJECT DATA Hospital: _____

Woman's MR# | **Monitoring by mother** ☐ Yes ☐ No

Mother's age years | **Gr** **Parity** | Date onset labour: / /

Stage of labour on admission ☐ Latent ☐ 1 ☐ 2 | **FHR normal on admission** ☐ Yes ☐ No

Type of birth ☐ NVD ☐ Accelerated vaginal ☐ Vacuum ☐ Caesarean | **Type of FHR change**

CS indication | **FHR change detected by mother** ☐ Yes ☐ No

☐ Maternal request | *FHR change confirmed* ☐ Yes ☐ No Any delay? ☐ Yes ☐ No

☐ Elective pregnancy complication | Date: / / Time:

☐ Emergency not FHR related | *Actions:* ☐ Lateral tilt ☐ IV infusion ☐ O2 ☐ Vacuum ☐ Caesarean

☐ Emergency FHR related | **Suspicious FHR detected** partograph ☐ Yes ☐ No Any delay?

Vac-m indication | *Actions taken:* ☐ Lateral tilt ☐ IV infusion ☐ O2 ☐ Vacuum ☐ Caesarean

☐ Suspicious FHR ☐ Other | Meconium present? ☐ Yes ☐ No

Mother alive ☐ Yes ☐ No **Complication of delivery** ☐ Yes ☐ No

Date of birth: _____ ☐ Boy ☐ Girl Multiple pregnancy ☐ Yes ☐ No

Time of birth: _____ Sequence number: _____

Baby alive at delivery ☐ Yes ☐ No **GA** wks. **BWt** gms | **Resuscitation** ☐ Yes ☐ No

Baby survived ☐ Yes ☐ No | Duration min ☐ Bag mask ☐ Chest compressions ☐ Medications

Apgars 1 min 5 min 10 min 15 min 20 min

Admission to neonatal ward ☐ Yes ☐ No *Indications:* ☐ HIE ☐ Respiratory ☐ HDN

HIE ☐ Yes ☐ No *HIE stage* | **Seizures** ☐ Yes ☐ No

Discharge home ☐ Yes ☐ No *Age:* specify

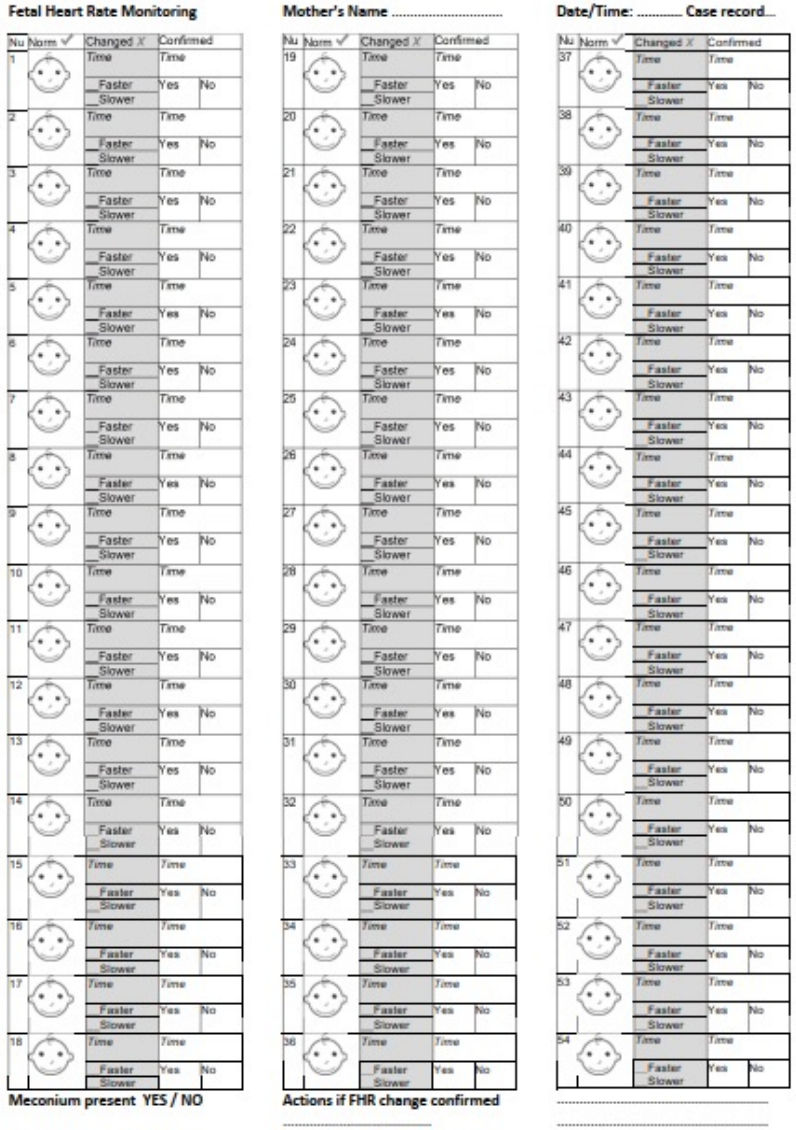
Cause of death: ☐ Asphyxia ☐ Complications of prematurity ☐ Infection ☐ Anomaly

☐ Other specify

Mother's comments on FHR monitoring: ☐ Good experience (2) ☐ Alright experience (3) ☐ Excellent experience (1) ☐ Poor experience (4) ☐ Very bad experience (5)

Written remarks by mother/partner re FHR monitoring:

Problems with FHR monitoring ☐ Yes ☐ No



Key findings of this program 1

- 6388 mothers were enrolled in 4 public hospitals between July 2017 and December 2022
- Almost every mother commented positively about assisting with fetal heart rate monitoring. Many directly expressed their empowerment (see details later)
- Intra Uterine Fetal Deaths (IUFDs) before hospital care remain much too prevalent (17.2/1000) and similar to those in other low-income countries. Obstetric outreach (discussed below) may have reduced prevalence in Grand Gedeh County but is urgently needed in all rural counties.
- **Intrapartum stillbirths (1.7/1000) and neonatal deaths (4.1/1000) are considerably lower than in other low-income countries.**
- The categories of birth asphyxia were: HIE with seizures 0.4%; Severe 3%; Moderate 2%; Mild 6% and absent 91%
- Excluding IUFDs 6288: 13 had Apgar scores 1-2 at 5 minutes; 34 had Apgar 3-4 at 5 minutes; 139 had Apgar 5-6 at 5 minutes; 5874 had Apgar 7-10 at 5 minutes without changes in FHR; 347 had Apgar 7-10 with changes in FHR.

  For those with no changes in FHR, Apgar score at 5 minutes was 10 in 5556 (88%)

  For those with changes in FHR, Apgar score at 5 minutes was 10 in 137 (2%)
- Excluding IUFD, 644 of 6288 (10%) received resuscitation involving bag and mask at birth

Key findings of this program 2

- There has been a dramatic reduction in intrapartum still births, neonatal deaths and Birth Asphyxia compared with other low-income settings

- A whole system development was needed: that is trained health workers, operational CEmONC facilities, emergency drugs and supplies- so that when Fetal Heart Rate change is identified, something can be done about it.

- The importance of integrated obstetric and neonatal care is revealed

- The empowerment of mothers by including them in the monitoring of their unborn babies appears to be a major advantage in helping them cope with the unrelieved pain of labour and often in the absence of partner support.

Key findings of this program 3

- There was only 1 maternal death out of the 6398 mothers enrolled in this program from 3 rural hospitals and 1 rural comprehensive EmONC facility. This mother died of post partum haemorrhage immediately following a Caesarean section for prolonged labour. There was an undeclared history of bleeding after previous deliveries. There was no evidence of FHR changes, and the baby was born in good condition with Apgar scores of 7 and 10. A major contributory factor was a lack of blood for transfusion.

- According to a recent (August 2023) USAID report from Liberia, the current Maternal Mortality Ratio in Liberia continues to remains extremely high at 742 deaths per 100,000 births (CI: 485-1,000) –DHS 2019/20.
- In 6398 hospital deliveries, the presence of only 1 maternal death where, based on the national figure, 47 might have been expected is encouraging and requires urgent further application of this whole task-sharing approach to maternity care in Liberia.
- However, the 6398 hospital deliveries required that mothers on admission were well enough to consent and undertake the monitoring. As a consequence of many factors involving the poverty of antenatal care, including remoteness and very poor roads, there have been maternal deaths that occurred either during transfer to the hospitals or immediately after admission because of the critical state of the mothers arriving in the 4 hospitals which meant they could not be included in the FHR monitoring. Investigations into all such deaths are currently undergoing analysis and will be presented in the next few months.
- It would also be interesting to discuss the possible contribution of the direct maternal involvement in contributing to the management of labour to the low rate of maternal death.

Key messages resulting from this program

1. The most important way forward in preventing consequences of BA involve more **support for the work force in the Liberian National Health Service (NHS)**. Adequate salaries for midwives and nurses who are functioning as obstetric and neonatal clinicians are needed. Most have not received the enhanced salaries promised after the completion of their training, despite their major contribution to provide 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 underway.

2. Urgent steps are needed to **minimise the number of IUFDs arising before hospital care**. 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. 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 Konobo in Grand Gedeh.

Key messages resulting from this program

3. As identified in other studies of BA in low-income settings the same difficulty to prevent 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, teenage and elderly mothers, PROM and PPROM, obstructed labour, prolonged labour, post-date pregnancy and multiple pregnancy Obstetric clinicians have received **special training in obstetric ultrasound** which is so valuable before and during labour.

4. However, there are situations that urgently require attention that will minimise BA. The 4-year national **stock-out of vital emergency drugs and materials** has created avoidable delays which have resulted in deaths and major morbidity in babies and mothers. 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.

5. Medical conditions such as severe anaemia and malaria in pregnancy need more attention. The use of i**ntravenous iron** where there is time before delivery to correct anaemia is inexpensive and safe. Malaria should not be occurring in Liberia, and nets and **Intermittent Preventive Treatment IPTp** need strengthening.

Key messages resulting from this program

6. Problems within the 2nd stage of labour predominate in the experience reported here as many mothers only reach hospital when fully dilated. By this stage mothers are often exhausted, badly affected by unrelieved pain, and cannot push out their babies. FHR as part of the WHO partograph and by mothers in this program is difficult to deliver

7. 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 Kiwi devices are about to be provided to CB Dunbar to assess their effectiveness in this situation.

8. The levels of 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 follow.

9. The presence of FHR changes in the 2nd stage of labour indicate the need for an **expert in resuscitation** (neonatal clinician, trained midwife or nurse anaesthetist) to be present at delivery.

10. Lateral tilt, intravenous fluids, and additional nutrition may have helped. Sometimes additional oxygen was given to the mothers, although further research is needed to assess its possible benefit.

11. Intravenous paracetamol has already been introduced into 2 of the 4 hospitals and has been accepted as effective in reducing the pain of uterine contractions. However, although relatively inexpensive, it has financial implications. The presence of a **close family member** in labour may help mothers to cope better and may make it more likely that they can successfully deliver vaginally.

Abbreviations used in this report

APH: Antepartum Haemorrhage

B and M: Bag and mask ventilation

C or CON: Uterine Contractions

CC: Chest compressions as part of resuscitation

CS Caesarean Section

D50%: 50% dextrose IV

Epis: Episiotomy

IUFD: Intra Uterine Fetal Death

FHR: Fetal Heart Rate

ISB: Intra-partum fetal death with FHR present on admission

IVF: Intravenous fluid usually 0.9% saline or Ringer Lactate

LBW: Low Birth Weight (2.5Kg or lower)

LLT: Left Lateral Tilt

MW: Midwife

NICU: Neonatal Intensive Care Unit

Pro. Lab: Prolonged Labour

VD Vaginal delivery;

NR: Not Recorded

OBC: Obstetric Clinician

O2: Additional inspired nasal oxygen

PET: Pre-Eclampsia

PROM: Prolonged Rupture Of Membranes

Background to this program 1.

- An international study in 2010 in a Liberian referral hospital (CB Dunbar) reported 1656 deliveries in one year. Out of these were 196 perinatal deaths; 143 classified as stillbirth and 53 classified as early neonatal deaths. [*Lori JR, Rominski S, Osher BF, Boyd CJ. A case series study of perinatal deaths at one referral center in rural post-conflict Liberia. Matern Child Health J. 2014;18(1):45–51. https://doi.org/10.1007/s10995-013-1232-y.}*

- The majority (**81 patients**) of stillbirths (56.6%) presented as antenatal stillbirths with no fetal heart sounds documented on admission. **Thirty-seven** (25.9%) had documented fetal heart rates upon admission with the stillbirth occurring during the intrapartum period. There was no documentation of presence or absence of fetal heart rates in 25 of the stillbirth records (17.5%).

- Of the **53** early neonatal deaths, **25** (47.2%) occurred on the first day of life. The largest single contributor to early neonatal death in the sample was birth asphyxia identified by poor Apgar scores (< 4 at 5 minutes). **Seventeen** of the 53 early neonatal deaths (32%) were due to birth asphyxia.

Background to this program 2.

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- Globally, intrapartum-related complications are reported to cause an annual 1.2 million stillbirths, 700,000 term newborn deaths, and an estimated 1.2 million newborn babies developing neonatal encephalopathy (birth asphyxia) with 233,000 survivors developing moderate or severe neurodevelopmental impairment *[Reference: Lee AC, Kozuki N, Blencowe H, et al. Intrapartum-related neonatal encephalopathy incidence and impairment at a regional and global level for 2010 and trends from 1990. Pediatr Res. 2013;74(suppl 1):50–72].*
- The countries with the highest stillbirth and neonatal mortality rates are in Sub-Saharan Africa *[Reference Lawn JE, Blencowe H, Oza S, The Lancet Every Newborn Study Group, et al. Every newborn: progress, priorities, and potential beyond survival. Lancet. 2014;384:189–205].*
- Between 25.1 and 34.2 stillbirths occurring for every 1,000 births, with an estimated 51% of these deaths happening intrapartum *[Reference Lawn JE, Blencowe H, Waiswa P, et al. for The Lancet Ending Preventable Stillbirths Series study group. Stillbirths: rates, risk factors, and acceleration towards 2030. Lancet 2016;387:587–603. Published online January 18, 2016].*
- For example, in a rural hospital in Tanzania, the stillbirth rate was 27/1000 live births, with 16/1000 occurring intrapartum and 27% of deaths in the first 6 days of life related to intrapartum causes. *[Reference Ersdal HL, Mduma E, Svensen E, Perlman JM. Early initiation of basic resuscitation interventions including face mask ventilation may reduce birth asphyxia related mortality in low-income countries: a prospective descriptive observational study. Resuscitation. 2012;83:869–73].*
- Compared with well-resourced countries, intrapartum-related neonatal mortality rates are 25-fold higher and intrapartum stillbirth rates up to 50 times higher in the lowest-income countries where rehabilitation services for children with neuro-developmental impairments are poor or absent. *[ReferenceLawn JE, Lee ACC, Kinney M, et al. Two million intrapartum-related stillbirths and neonatal deaths: Where, why, and what can be done? Int J Gynecol Obstet. 2009;107:S5–S19].*

Background to this program 3.

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- In 2013 MCAI began a series of projects aimed at reducing the massive neonatal and maternal mortality rates in Liberia.
- The causes 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 included the training of obstetric and neonatal clinicians and the recruitment of mothers during labour to work with midwives, obstetric and neonatal clinicians and doctors to enhance the monitoring of the well-being of the unborn baby.
- Information on the training of obstetric and neonatal clinicians is provided at the end of this report.

A pilot study involving the enrolment of mothers in fetal monitoring was published in 2020:

K. Borzie, N. Jasper, D. P. Southall, R. MacDonald, A. A. Kola, O. Dolo, A. Magnus, S. D. Watson, M. Casement, B. Dahn and W. Jallah. Monitoring intrapartum fetal heart rates by mothers in labour in two public hospitals: an initiative to improve maternal and neonatal healthcare in Liberia. BMC Pregnancy and Childbirth (2020) 20:362 https://doi.org/10.1186/s12884-020-02921-z

Providing mothers with fetal heart monitors Enabling mothers in labour to monitor their baby's heart is improving maternal and neonatal outcomes in Liberia. Tatum Anderson reports. Bull World Health Organ 2020;98:445–446 | doi: http://dx.doi.org/10.2471/BLT.20.020720

Definitions used in this present study

- Birth asphyxia, also called perinatal asphyxia, is a complex condition related to a failure of placental function before or during delivery. Cord accidents, such as cord prolapse and cord entanglement, and antepartum haemorrhage from abruption or placenta praevia can also cause it, irrespective of prior placental function.

- This condition can manifest itself as Intra Uterine Fetal Death(IUFD) occurring before or during labour at home, in a clinic or in a hospital. In this paper we record intrauterine deaths occurring during labour and after arrival in hospital as stillbirths and when occurring before arrival alive in hospital as IUFDs.
- Birth asphyxia can also result in the failure of the newborn to start breathing at the time of birth. The definitions used in this paper relate to a combination of Apgar scores at 5 minutes and whether or not resuscitation involving bag and mask ventilation was considered necessary at birth.
- In the early newborn period (defined here as the first month of life) birth asphyxia can result in neurological disorders including seizures, failure to feed, and serious permanent brain damage and in neonatal death.

Definitions of Birth (Perinatal) Asphyxia used in this report

- Apgar < 7 at 5 mins = Severe Birth Asphyxia (SBA),
- Apgar 7 at 5 mins with or without resuscitation = Moderate Birth asphyxia (BA),
- Apgar 2 or 3 at 1minute even with an Apgar score at 8 or more at 5 minutes after birth regardless of resuscitation = (BA)
- Apgar 8, 9 or 10 at 5 mins +Resuscitation (Defined as BagMask +/- Chest compressions but not just suction or stimulation alone) = Mild Birth Asphyxia (MildBA)
- Apgar 8, 9 or 10 at 5 minutes without resuscitation = No Birth Asphyxia (NoBA)
- Seizures accompanying birth asphyxia = Hypoxic Ischaemic Encephalopathy (HIE)

Resuscitation involves the baby receiving bag and mask ventilation

Results of Fetal Heart Rate (FHR) monitoring in 4 rural public hospitals in Liberia 1.

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Hospital	Dates of enrolment	Numbers of mothers enrolled	Numbers of IUFDs	Numbers of intrapartum stillbirths IPS	Numbers of Neonatal Deaths NDs due to birth asphyxia
MTMH	9/4/20 to 30/12/22	1781	15	2	4
CB Dunbar	31/7/17 to 30/12/22	3360	63	5	18
Sinje	2/11/21 to 31/12/22	325	20	3	1
Lofa	13/4/21 to 29/12/22	932	12	1	3
	TOTALS	6396	110	11	26
Note rates for IPSs and NDs based on those enrolled less IUFDs (6288)		*6288*	*17.2/1000*	*1.7/1000*	*4.1/1000*

Results of Fetal Heart Rate (FHR) monitoring in 4 rural public hospitals in Liberia 2.

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Hospital	Numbers of mothers enrolled	Numbers with abnormal FHR detected	Numbers of HIE	Numbers of Severe Birth Asphyxia SBA	Numbers of Moderate Birth Asphyxia BA	Numbers of Mild Birth Asphyxia Mild BA	Numbers without birth asphyxia NoBA	Resus. of the newborn performed
MTMH	1781 (1766)	246 (14%)	20	82	63	157	1440	317
CB Dunbar	3360 (3297)	189 (6%)	3	72	48	111	3166	215
Sinje	325 (305)	22 (7%)	0	17	5	21	261	37
Tellewoyan	932 (920)	33 (4%)	0	17	8	57	838	75
TOTALS	6396 (6288)	490 (8%)	23(0.4%)	188 (3.0%)	124 (2.0%)	346 (5.5%)	5705 (91%)	644 (10.2%)
Figures in brackets after removal of IUFDs								

Clinical details of IUFDs (all identified on arrival at local hospital)

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Hospital	No: IUFD	Fresh (F) or Macerated (M)	Infected (I) not infected (NI)	Laboured at home, or clinic or both	Obstetric issues	High risk factors
MTMH (from 899 – 1752) 18/1000	15	8F 7M	5I 10NI	9 home, 3 clinic, 2 both, 1 hospital (FJ Grant)	1 placenta praevia, 1 cord prolapse, 1 ruptured uterus (with APH)	1 referred from clinic with fetal distress 2 post term. (1 refused induction returned 5 days later with IUFD) 3 aged >34 years (36,38,41) CHECK
CBD (from 1635-3409) 36/1000	63	23F 38M 2 NR	30 I 33 NI	27 home, 34 clinic, 2 Phebe Hospital	4 Previous CS (1 x 3) 1 polyhydramnios Anencephaly; 2 cord prolapse 3 twin; 6 breech; 2 face, 1 NR; 3 preterm; 4 APH; 1 eclampsia; 2 malaria	7 obstructed labour 1 prolonged labour 2 ruptured uterus 1 no surgical materials 23 Aged >34 or < 18 yr (7 aged 16, 3 aged 40+) Severe anaemia = 1
Sinje 74/1000	20 5 CS, 1 Vacuum	0 F 20 M	17 I, 3 NI	4 home, 1 clinic, 15 NR OBTAIN	APH 3 (1 praevia); 6 malaria; 1 face; 2 preterm; 5 breech; 1 eclampsia; 1 cord prolapse;	1 ruptured uterus; 8 obstructed labour; 2 PROM; 4 anaemia; 1 aged 37; *ages needed only 3 recorded CHECK*
Tellewoyan 29/1000	12	5F 7M	7 I, 5 NI	2 home Data needed	APH 3 (2 praevia), cord entangled 1; Anaemia 1; Breech 2; 3 obstructed labour	3 aged > 34 years; CHECK
TOTALS	110 17.2/1000					

Comments: Tragic figures with lowest at MTMH probably reflecting obstetric outreach since 2019. Even there, some patients were referred to hospital but could not reach due to poverty, poor roads (especially rainy season), lack of ambulance, fuel and drivers. Major problems such as age < 18 or > 34, placenta praevia, severe preeclampsia, PROM unmanaged, breech, severe anaemia (eg Hb 3g/dl), prolonged obstructed labour sometimes with ruptured uterus, previous CS etc. Urgent need for obstetric outreach in all rural counties. Better roads, more functioning ambulances and essential drugs and supplies. Mothers should go to hospital as soon as labour starts. Clinic staff need training in neonatal resuscitation (about to begin in 4 rural counties). Local press and radio need to provide information. CEmONC facilities in far-to-reach areas such as Konobo in Grand Gedeh need urgent development.

Clinical details of Intrapartum Still Births ISBs (all occurring during labour in each of the 4 hospitals)

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Hospital	No: ISBs	Prior FHR changes	Abnormal FHR identified ?	Obstetric abnormalities present	Modes of delivery	High risk factors
MTMH	2	2	1. FHR 164 Fully dilated 2. 14 con. FHR down to 77bpm after 7 normal	Breech Severe preeclampsia 28 wks 1.9Kg	VD IVF VD after IVF, LLT	Breech extraction: head stuck. Mother 44 yr Mother aged 33 years
CBD	5	4	See next Tables for details		1 VD 4 CS	
Sinje	3 Age NR, 28y, 30y	2	**1**.No FHR abnormality **2 and 3**. FHR bradycardias	Obstructed labour Ruptured uterus Obstructed labour, eclampsia, Polyhydramnios and Anencephaly	Emergency CS for all 3	CS in previous pregnancy. Major delay in reaching hospital Late referrals
Tellewoyan	1 29y	No	Fetal distress during delivery	Cord entanglement at delivery	CS	Laboured mostly at home
	11 **1.7/1000**	8				

Comments: 8 of 11 had prior FHR abnormalities. 2 difficult breech deliveries (antepartum external version, when possible, or CS may have avoided these stillbirths). Major stock-out of essential emergency drugs and supplies in clinics and hospitals over last 2 years is especially relevant for poverty-stricken families. (a high risk for both maternal and fetal deaths). Delay in reaching hospital, especially after prolonged obstructed labour (including one woman with ruptured uterus). In one patient arriving at hospital, FHR abnormality identified but no oxygen, drugs or supplies available and no laboratory materials to screen blood from relatives for transfusion. Mothers are still labouring in homes where unqualified birth attendants, or in clinics where midwives are not trained adequately to manage complicated obstetric emergencies. There are delays in referrals, either from health workers in clinics or the lack of fuel for ambulances (which families cannot afford to purchase) or ambulances are broken down. Need for obstetric outreach to far-to-reach clinics to identify and manage high risk cases.

Intrapartum stillbirths at CB Dunbar Hospital

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Patient No: Age y	FHR finding prior to death	Obstetric diagnosis	Actions at delivery	Summaries of special issues identified
463 21y	28 contractions normal VD	Breech	Episiotomy during delivery	Referral, breech presentation, difficult breech delivery. **Mother's Comment** *I felt happy doing my baby heart beat. It make me to be strong. Even though my baby did not live but that is the work of God. I know every one did well.*
1675 24y	Normal at onset but 6th contraction 112bpm. OBC informed when FHR changed. repeated and 100bpm. O2, IVF, D50% then 90 bpm at time of CS	On admission leakage of membrane	IVF D50% Caesarean CS	Referral, prev c/s x 1, NRFS
1772 26y	Normal to start but then 26th contraction 100bpm Previous CS x1Meconium CS materials requested from relatives 9 hours later available but Lab-Tech no materials to screen blood. At 2am 15 hrs later FHR 92-169bpm At 17 hrs later CS in OR Dead baby extracted	Diagnosis: prolonged active phase of labour, CPD	Relatives requested to give blood before Caesarean. IVF, LLT, D50%	Previous C/S x1, absent membrane, greenish fluid seen on examination gloves, OBC called to assess patient and ordered that patient be prepared for C/S after assessment, C/S materials prescription given to patient relatives at 11am. Relatives made available materials at 7:50pm, donors sent to lab for test of blood but Lab technician said there were no materials. At 11:05pm, OBC still awaiting blood, FHR- 100b/m, N/S 500ml and D50% IV served, patient encouraged to lay on left side and FHR closely monitored. At 11:40pm, MGSO4 loading dose served. 1:00am, patient relatives prepared to provide blood and waiting to be checked but still no materials in Lab. Fluctuations in FHR started at 2:00am ranging from 92-169b/m, N/S 500ml, D50%, O2 administered and patient encouraged to lay on left side and closely monitored. Dr. on call was informed about patient condition but was busy in ICU with another patient. At 3:30am, Dr ordered patient be prepared and taken to operating room for emergency C/S. Anesthetist confirmed patient be taken to for C/S. At 4:10am, ceftriaxone 2grams IV served. Patient taken to OR at 4:15am. Dead neonate abstracted.
2151 36y	Came fully dilated DR FOUND FHR 100bpm CS	Face presentation. macrosomia	IVF, D50%, LLT O2; Emergency CS	Referral, face presentation, poor maternal efforts to push
2400 18y	From 1st contraction = 160bpm/138bpm from 19th contraction=100bpm CS	Multiple gestation. Prolonged latent phase.	LLT, IVF, D50%. Caesarean.CS	Referral. Prolonged pregnancy, painful distress, breech presentation of first twin, oedema of the legs, pre-eclampsia, previous C/S x 2 Twin 1. Second twin normal Apgar 8-10 see later Table

Further analysis of Intrapartum stillbirths at CB Dunbar Hospital

DRAFT

- 1 had no change in FHR and the other 4 showed major FHR changes prior to the stillbirths.
- The first patient had a normal FHR, but a breech malpresentation. Delivery was accompanied by an episiotomy but was recorded as difficult during which the fetus died. There is a regular occurrence of problems relating to a link between birth asphyxia and breech delivery. There is a need to identify breech malpresentation in late pregnancy and consider external version to a cephalic presentation or CS depending on circumstances.
- The second patient had marked FHR changes which despite CS resulted in stillbirth. There was a previous history of a CS in an earlier pregnancy. CHECK was there any delay with the CS?
- The third patient's death was undoubtedly related to the long-standing "stock out" of drugs and materials needed for emergency obstetric care. There is a so-called revolving system that provides drugs and materials for emergencies at CB Dunbar Hospital. However, the system frequently doesn't work with major delays, especially for those families who do not have immediately available money to purchase the drugs and supplies. Also, the hospital pharmacy frequently runs out of emergency drugs and supplies and families need to go to a nearby pharmacy and buy them. These dangerous delays in providing emergency care can result in both maternal and fetal deaths (especially if the family do not have the funds: approximately 90% of the community). There is a need for community and donor awareness of this problem and advocacy at all levels to overcome it.
- The 4th patient had a malpresentation and an emergency CS was undertaken (CHECK was there any delay?)
- The 5th patient was carrying a twin pregnancy with prolonged labour and one of the baby's died. However, the second twin did well. The mother considered that all that could have been done was undertaken. Please CHECK and find out whether there was any delay with undertaking the emergency CS.

Neonatal deaths

DRAFT

Hospital	Age yrs	N:	FHR normal	FHR abnormal C = contractions	ACTIONS Mode of Delivery	Any obstetric disorder. Yes/No If yes describe	Apgar 1-5	Neo natal resus min?	NIC U Adm it days	Seiz ure s in NIC U	Details of deaths Ages at death(d=days) Birth asphyxia
MTMH	21 30 31 30	4	0 5c 5c 14c	21c all <120 4c 110-118 3c 116-120 6c 105-110	NS x 3, D50 **CS** NS, D50, VD **CS** IVF, **VD** IVF, Oxytocin **VD**	Obstructed labour Major delay drugs, materials, blood Bwt 3.9Kg Fully dilated. 3.0Kg 3.2Kg	1-2 2-3 3-4 1-1	3 6 20 28	2 4 3 1	0 Yes 0 0	2d Severe BA 4d HIE 3d Severe BA 1d Severe BA
CBD		18	4	14		SEE NEXT TABLE		18		2	2 HIE 16 severe BA
Sinje N 325 (305)	15	3	30 c. 31 c. 39c	0 0 0	2 VD Induced Miso **VD**	----- Malaria, preterm 1.6Kg, APH, UTI Malaria, postdate,	7-10 4 – 8 3-4	0 0 30	2 6	0	6d No BA Sepsis 5d No BA Sepsis 1d Severe BA, malaria, sepsis
Tellewo yan	31 28 NR 35	4	15 c. 1 c.	 40 con= 116 34 con = 127	VD Elective CS Quick VD O_2 Quick VD O_2	Preterm 27 wk 1.3Kg 2 previous CS Preterm BWt 1.3 Kg	5-10 7-10 1-2 6-10	3 3 8 5	4 1 2 3	0 0 0 0	6d Mild BA Sepsis 1d conjoined twin 2d Severe BA 3d Mild BA sepsis
TOTALS		29	9	20				26		3	3 HIE; 21 Severe BA; 2 mild BA; 3 No BA
MTMH	*21*	*1*	*3*	*3 normal then 3 110-118*	*VD after prolonged pushing IVF, D50*	*2.3Kg* ***POST NEONATAL DEATH***	*2-4*	*12h every 30m*	*31*	*0*	*31 d Severe BA*

Comments: 29 cases (+1 died aged 31 days with severe BA). 9 had normal FHRs and 20 abnormal FHRs during monitoring. 6 LBW/preterm (one 27, one 34 wks). Two vacuum deliveries (definitely need more vacuum or forceps extractions when fully dilated but delay in 2nd stage and FHR abnormal). Three seizures (HIE), 19 severe BA, 1 Moderate BA, 2 mild BA . Three did not have birth asphyxia, including 1 conjoined twin and 2 neonatal sepsis. Two (1 with obstructed labour and fetal distress and 1 with fetal distress) needed urgent CS which were delayed because of 4-year *"stock-out"* of essential emergency drugs and materials; including blood for transfusion in 1 case; both developed severe BA and died.

Neonatal deaths CBDunbar Hospital

DRAFT

Hospital	Age yrs	N: 18	FHR normal C= cons.	FHR abnormal C = cons.	ACTIONS Mode of Delivery	Any obstetric disorder. Yes/No If yes describe	Apgar 1-5	Neonatal resus min?	NICU Admit days	Seizures in NICU	Details of deaths
CB Dunbar		18 17	1 2 at 120 1 at 120	0 refused	**VD** **VD** **Vacuum**	2.4Kg Poor maternal expulsive efforts Fully dilated with ruptured membranes WHY?	2-6 3-5 3-5	15 3 5	3 1 2	Yes No no	3d HIE 1d Severe BA 2d Severe BA Sepsis
	36y		37 1 at 120		**VD** Delay pushing out baby Emergency **CS**	Obstructed labour Ruptured membranes >18hrs	5-6 3-6	9 5	1 2	No no	1d Severe BA 2d Severe BA
				15 down to 30 45 down to 92	VD LLT IVF **CS**	Preterm 34 wks 1.3Kg Prolonged labour	2-0 2-4	25 2	1 2	Yes no	1d (5 mins only) HIE 2d Severe BA
	17y		3	28 down to 100 24 down to 118	LLT, IVF, D50 **CS** for FHR **VD**	Delay 2.5 hrs lack materials 2.8Kg Difficult VD 2.4Kg	5-6 2-3	10 25	2 1	No no	2d Severe BA 1d (12hr) Severe BA
			24 28	7 down 116-100 1 down 110-90	IVF, D50, O2 **VD** IVF, D50, O2 **Vacuum**	Fully dilated at 24 con. Prolonged 2nd stage	4-5 3-5	10 3	9 4	No no	9d Severe BA 4d Severe BA
			33 28	33 = 100 Fully dil. 28 = 98	IVF, D50, O2 **Vacuum** **Episiotomy** quick **VD**	Poor maternal expulsive efforts Fully dilated	3-7 2-4	2 10	2 4d	No no	2d Severe BA 4d Severe BA
				1 = 116	**Emergency CS**	Referred twins with cord prolapse First twin needed resus.	4-6	6	4	no	4d Severe BA
	16y		43	1 = 75 43 = 105	**VD** **Episiotomy and fast VD**	Fully dilated At full dilatation FHR 105	0-3 3-5	30 11	1 1	No No	1d (30min)Severe BA 1d Severe BA
	17y 35y		26	26 = 109-100 1 = 115	LLT, IVF, O_2 **VD** **VD**	1.9Kg Arrived fully dilated	2-4 5-6	10 15	No 1	No no	1d (mins) Severe BA 1d Severe BA
TOTALS		18	5	13							2 HIE; 16 Severe BA

Summary of clinical data on neonates with Apgar scores of 1 or 2 at 5 minutes and birth asphyxia

DRAFT

Hospital	N total	N with Apgar scores 1-2	N yes change FHR Slow Fast NR	N no change in FHR	Birth	N Resus Mins	Obstetric issues	Apgar 1-5 min	Seizures	Birth asphyxia status
CB Dunbar	3360 (3297)	3	2 fast	1	3 VD	5; 3; 25	2 breech, 1 preterm 0.8Kg	1-2 1-2 ??	2 No 1 NR	Severe BA Severe BA Severe BA
MTMH	1781 (1766)	8	5 all slow	3	7 VD 1 CS	3-30	1 breech 1 obstructed labour and LBW	7 at 1-2 1 at 0-2	4 Yes	4 HIE 4 Severe BA
Lofa (T)	932 (920)	2	2 1=fast 1 = slow		2 CS	30; 20	Prolonged labour x2	1-2 1-2	No	Severe BA Severe BA
Sinje	325 (920)	0								
TOTALS	**6398 (6288)**	**13**	**9**	**4**	**10 VD 3 CS**				**4**	**4 HIE 5 Severe BA**

Figures in brackets excluding IUFDs

Apgar scores of 1 or 2 at 5 minutes (all neonates survived and went home)

DRAFT

Hospital	Age yrs	N:	FHR normal	FHR abnormal C = contractions	ACTIONS Mode of Delivery	Any obstetric disorder. Yes/No If yes describe	Apgar 1-5	Neonatal resus min?	NICU Admit days	Seizures in NICU	Presence of BA
MTMH	16y	8		100-108 on arrival fully dil.	IVF, D50% **VD**	-	1-2	30	9	Yes	HIE
				90-101 on arrival 8cm	IVF, D50% **VD**	-	1-2	3	6	No	Severe BA
			4c		Breech extraction **VD**	Footling breech CS refused	1-2	6	8	No	Severe BA
			3c	3c at 104-113	LLT, IVF, **VD**	Fully dilated on arrival	0-2	6	6	Yes	HIE
				6c 100-109	IVF **CS**	Obstructed labour 2.4Kg	1-2	15	14	Yes	HIE
				1c 100 on arrival fully dil.	IVF, Push **VD**	3.5Kg	1-2	10	9	Yes	HIE
			3c		**VD**	2.9Kg	1-2	6	12	No	Severe BA
			12c		**VD**	Meconium	1-2	5	10	No	Severe BA
CBD		3	42		**VD**	Breech	1-2	5	Yes	No	Severe BA
				1 con. 182	LLT, IVF, **VD**	Preterm ?GA 0.8Kg	1-2	3	Yes	No	Severe BA
				1 con 160	**VD** Fully dilated	Breech Difficult Footling 3Kg	???	25	Yes	?	Severe BA
Sinje		0									
Tellewoyan		2		1 con. 112	O2, **CS**	Prolonged labour, CPD	1-2	30	Yes	No	Severe BA
				C1 174, c4 182	LLT, O2**, CS**	Prolonged labour, CPD	1-2	20	Yes	No	Severe BA
TOTALS		13	4	9							

Comments: Of 8 at MTMH, 5 had changes in FHR. 4 changes in FHR on arrival of which 3 were fully dilated . One treated by CS for obstructed labour (aged 16)
1 normal FHR then abnormal FHR Fully dilated. 3 normal FHR prior to birth. All 8 babies were admitted to NICU: 4 suffered seizures 4 had HIE (all had changes in FHRs) and 4 had SBA (3 normal FHRs and 1 changes FHR). All 8 needed resuscitation 3-30 minutes duration

Of 3 at CB Dunbar, 2 had breech; one was described as a difficult vaginal delivery . Both at Tellewoyan had prolonged labour and CPD.

Difficult to manage those presenting fully dilated. Need much more vacuum assistance rather than relying on maternal pushing because by this stage the mother may be too tired. She may also be ketotic and be assisted by sugar drink orally. Also need earlier referral and FHR monitoring at clinics

Apgar scores of 3 or 4 at 5 minutes (all neonates survived and went home)

Hospital	Age yrs	N:	FHR normal	FHR abnormal C = contractions	ACTIONS Mode of Delivery	Any obstetric disorder. Yes/No If yes describe	Apgar 1-5	Neonatal resusmin?	NICU Admit days	Seizures in NICU	Presence of BA
MTMH See Table		24	6 See Table	18 See Table	**18VD** **4 CS** **2 vacuum**	4 breech; 2 cord tangles; 5 LBW; 1 previous CS; 1 transverse lie; 1 prolonged obstructed labour; 1 post date induction; 1 refuse to push; 2 prolonged labour; 1 CS planned but VD	See Table	24 (2-15)	24	4	4 HIE 20 Severe BA
CBD	18y 31y 18y 30y 21y	6	22c 22c 2c	 26c 110 28c 100 At 29c 109 1c 100	**VD** **VD** **CS** **VD Episiotomy** **VD** **VD**	 Obstructed labour, ruptured uterus during CS Fully dilated on arrival	2-4 2-4 2-4 2-4 3-4 2-3	7 5 5 20 3 23	Yes Yes Yes Yes 7 Yes	No No No No No No	Severe BA Severe BA Severe BA Severe BA Severe BA Severe BA
Sinje		3		1c 118 1c117 14c 119-123	**VD** IVF**, CS** **VD**	Malaria Prolonged obstruct labour 7cm dilated Meconium Prolonged labour. CS but no blood and delay ++	3-4 2-3 4-4	5 7 10	7 7 5	No No no	Severe BA Severe BA Severe BA AMA
Lofa (T)	18y	1	42c		**VD**	Cord entangled	3-4	16	5	no	Severe BA
TOTAL		**34**	10	24	**26VD; 6CS; 2 Vacuum**			Yes 34	Yes 34	4	4 HIE 30 severe BA

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Comments: 3 had prolonged obstructed labour; 2 prolonged labour; 4 had breech and 1 transverse lie malpresentations; 3 had cord tangles; 1 refused to push; 1 had malaria. .
Malaria should be prevented by nets and IPT.
4 had HIE level birth asphyxia, and 30 severe birth asphyxia.
All 34 received resuscitation.
Only 2 were vacuum deliveries.

Table MTMH Apgar scores of 3 or 4 at 5 minutes (all neonates survived and went home).

Hospital	Age yrs	N:	FHR normal	FHR abnormal C = contractions	ACTIONS Mode of Delivery	Any obstetric disorder. Yes/No If yes describe	Apgar 1-5	Neonatal resus min?	NICU Admit days	Seizures in NICU	Presence of BA
MTMH	38y	24	9c		**VD**	2.4Kg	3-4	10	9	No	Severe BA
	17y		4c		**VD** Refused after 4		2-3	4	7	No	Severe BA
	33y		4c	3c 116, 182	IVF, D50 **CS**		3-4	25	4	No	Severe BA
	32y		5c	2c 100-110	**IVF, D50 VD**	2nd Twin 1.8Kg	3-3	7	5	No	Severe BA
	19y		2c		**VD**	Double cord entangle 3.1Kg	2-4	10	9	No	Severe BA
	21y			3c 116-119	**VD** IVF, D50	Breech on arrive 9cm 2.9Kg	2-3	5	8	YES	HIE
	29y			2c 102 -112	VD	On arrival Breech Buttocks at perineum 2.2Kg	2-3	15	6	No	Severe BA
			2c	2c 115-118	**VD** IVF, D50	1.1Kg preterm	2-3	8	9	Yes	HIE
	19y			2c 109-119	IVF, D50 **CS**	On arrival Breech 3.8Kg	2-4	6	10	Yes	HIE
	33y		11c		**VD**		3-4	7	10	No	Severe BA
	35y		3c	3c 104-119	IVF **VD**	Previous CS 2.9Kg	2-4	7	11	No	Severe BA
	40y		6c	2c 108-119	**VD**	Breech	2-3	3	5	No	Severe BA
	25y		4c	2c 117-119	**IVF, D50 VD**	2.2Kg preterm	2-4	3	7	No	Severe BA
	30y		6c 4c	6c 108,117,118	LLT **VD**	3.2Kg	3-4	2	7	Yes	HIE
	22y		15c	7c 153-190	**CS**	Transverse lie 3.8Kg	3-4	5	7	No	Severe BA
	18y		15c	7c 107-109	IVF, Oxytocin, Push **VD**	2.7Kg	2-4	8	5	No	Severe BA
			3c	4c 170-182	**IVF, CS**	Prolonged obstructed labour	2-4	10	11	No	Severe BA
	31y		5c	3c 106-108	**IVF, D50 VD**	3.8Kg Double cord entangled	3-4	3	7	No	Severe BA
	18y		22c		**VD**	Postdate Misoprostol induction	2-3	5	8	No	Severe BA
	19y		17c	5c 100-109	**IVF Push VD**	2.3 Kg	2-4	13	8	No	Severe BA
	23y		11c	6c 98-106	**IVF Vacuum**	Refuse push 3.1Kg	2-4	15	7	No	Severe BA
	17y			1c 90-109	**IVF, episi. Vacuum**	On arrival prolonged second stage 3.1Kg	2-3	5	15	No	Severe BA
	23y			1c 188	**VD**	Prolonged labour CS planned but VD 3.3Kg	2-3	3	8	No	Severe BA
	21y		11c		**VD**	3.5Kg	1-4	5	6	No	Severe BA
TOTALS			6	18		4 breech, 2 cord entangle, 5 LBW					4 HIE, 20 SBA

Comments: Of 24 at MTMH, 5 had FHR changes on arrival and 13 normal on arrival but then developed changes. 6 showed no FHR changes. All 24 were admitted to NICU where 4 suffered seizures.

All received resuscitation using bag and mask. 4 were categorized as HIE and 20 as severe birth asphyxia. 5 were of low birth weight.

Two double cord entanglements could have represented 2 cases of mono-amniotic twins. CHECK whether ultrasound was used here.

Apgar scores of 5 or 6 at 5 minutes (all babies survived and went home) N = 139

Hospital	Age yrs	N:	FHR normal	FHR abnormal contractions	ACTIONS Mode of Delivery	Any obstetric disorder. Yes/No If yes describe	Neonatal resus	NICU Admit days	Seizures in NICU	Presence of birth asphyxia
MTMH		67	16	51	**49VD;16CS;2 Vacuum**	See Table	67	67	13	13 HIE 54 SBA
CBD		46	24	22	**31VD; 10CS;5 vacuum**	See Table	45 +1NR	43 +3NR	3	3 HIE 43 SBA
Sinje		13	8	5	**8VD; 4CS; 1 vacuum**	See Table	12 +1NR	13	0	13 SBA
Lofa		13	10	3	**6VD; 6CS; 1 vacuum**	See Table	13	13	0	13 SBA
TOTAL		139	58 42%	81 58%	**94 VD = 68%** **36 CS = 26%** **9 vacuum = 7%**		137 (99%) (+2 NR)	136 (98%) (+3NR)	16 (11.5%)	16 HIE = 12% 123 Severe BA = 88%

Comments: 58 had no change in FHR and 81 (58%) had changes. !6 had HIE (12%) and One hundred and twenty-three had severe birth asphyxia

For MTMH: 2 had placenta praevia and APH; 1 breech; 1 transverse lie; 2 major delay before CS as family tried to get materials one ended up VD; 1 cord prolapse; 1 cord tangle; 2 eclampsia; 1 retained 2nd twin; 6 long stay home or clinic; 1 preeclampsia twin; 5 delayed 2nd stage as couldn't push; 2 encouraged push; 10 LBW.

Table Apgar scores of 5 or 6 at 5 minutes (all survived and went home)

Hospital	Age yrs	N:	FHR normal	FHR abnormal C = contractions	ACTIONS Mode of Delivery	Any obstetric disorder. Yes/No If yes describe	Apgar 1-5	Neonatal resusmin?	NICU days	Seizures in	Presence of BA
Sinje		13		44c 119	6cm **VD** declined CS		3-6	10	6	no	Severe BA
			1c 120		**VD**	Fully dilated delivered in 5 mins. Omphalocele	3-5	6	13	no	Severe BA
				1c 116	4cm IVF, D50**, CS**	Prolonged labour.Meconium	3-6	10	5	no	Severe BA
				40c 112	**VD**	Eclampsia 3.6Kg MgSO4, Hydrallazine	3-6	5	14	no	Severe BA
			44c		**Vacuum**	Unable to push Primigravida	4-6	7	5	no	Severe BA
				Yes brady	**CS**	Twin, malaria, IUGR, Twin 1 =1.7Kg	4-5	5	8	no	Severe BA
	17y		44c		Scared to push **VD**	Anaemia, malaria, Primigravida	4-6	7	8	no	Severe BA
	15y		33c		Unable to push **VD**	Episiotomy, malaria	3-5	5	2	no	Severe BA
			45c		**VD**	Prolonged obstructed labour	5-6	3	6	no	Severe BA
				28c 172	**VD**	Preeclampsia, MgSO4, IVF, D50, O2	3-6	No	5	no	Severe BA
			10c		**CS**	Face presentation	4-5	3	5	no	Severe BA
			1c		**CS with fetal distress**	Previous CS Problem getting baby out of uterus	2-6	4	5	no	Severe BA
			30c		**VD**	Problem delivering baby vaginally	4-5	5	5	no	Severe BA
Lofa	18y	13	28c		**VD**	Poor maternal efforts to push Prolonged 2nd stage	3-5	12	6	No	Severe BA
	16y		1c		**CS**	Prolonged labour CPD	4-6	5	9	No	Severe BA
	19y			37c 116	**VD** Quick delivery, O2		3-6	10	6	No	Severe BA
	25y		1c		**CS**	APH	2-6	15	7	no	Severe BA
	38y		15c		**VD**	Prolonged 2nd stage Shoulder dystocia	4-6	5	6	no	Severe BA
	25y		1c		**CS**	CPD	3-6	7	7	no	Severe BA
	18y		35c		**VD**	Difficult vaginal delivery Mum scared to push Anaemia	3-5	30	10	no	Severe BA
	21y		34c		**Vacuum**	Unable to push out baby	3-5	15	Yes	no	Severe BA
	30y		1c		**CS**	Previous CS Prolonged labour		30	5	no	Severe BA
	35y			3c119-122	**CS, IVF O2**	Previous CS,CPD		2	5	no	Severe BA
	19y		41c		**VD**		4-6	10	5	no	Severe BA
	35y			1c	**CS**	Fetal distress 3.8Kg	4-5	10	5	no	Severe BA
	28y		46c		**VD**	3.3Kg Anaemia in pregnancy	4-5	8	7	no	Severe BA
TOTALS		**26**			**14 VD; 10 CS; 2 vacuum**			**25**	**26**	**0**	**26 severe BA**

Comments: In Sinje 3 cases of malaria; 1 face presentation; 1 eclampsia and 1 preeclampsia; 1 problem delivering baby during CS and 1 delivering baby vaginally.

In Tellewoyen 1 difficult vaginal delivery by OBC. 2 mothers unable to push. 1 prolonged 2nd stage due to shoulder dystocia. There was also 1 case of antepartum haemorrhage and 2 cases of anaemia.

MTMH Apgar scores of 5 or 6 at 5 minutes (all survived and went home) *1 of 2 analyses*

Hospital	Age yrs	N:	FHR normal	FHR abnormal C = contractions	ACTIONS Mode of Delivery	Any obstetric disorder. Yes/No If yes describe	Apgar 1-5	lResus min	NICU days	Seizures	Presence BA
MTMH 1	39y	65	5c		CS	Retained 2nd twin Meconium	5-6	Yes	10	No	Severe BA
	17y			3c 117-119	CS LLT, IVF, D50	For FHR changes Long stay in clinic		2	6	no	Severe BA
	32y		5c	3c 113-115	CS LLT, IVF, D50	Placenta praevia 2.4Kg		1	O	no	Severe BA
	24y			1c 102-119	VD, LLT, IVF, D50	Fully dilated birthing chair 2.5Kg		10	5	no	Severe BA
	21y		2c		VD Pushed	Fully dilated head visible 1.9Kg		5	5	no	Severe BA
	41y			3c 116-119	CS LLT, IVF, D50	Transverse lie, polyhydramnios 2.0Kg	5-6	NR	3	no	Severe BA
	18y		11c		VD Breech	CS planned but delay in materials thus VD 2.0Kg		5	4	no	Severe BA
	24y		6c		VD	3.5Kg	4-5	15	5	Yes	HIE
	16y		3c	5c 114-119	CS LLT, IVF, D50	2.8Kg Eclampsia, obstructed labour		6	8	Yes	HIE
	28y		2c	4c 117-119	IVF VD	3.3Kg	4-5	20	11	Yes	HIE
	34y		5c	6c 116-119	IVF, CS refused at 5cm	3.8Kg		15	7	No	Severe BA
	18y		2c	4c 115-119	Fully dilated,IVF VD	Stayed long at home Birthing chair 3.4Kg	2-5	5	4	No	Severe BA
	37y			c 112-119	Fully dilated,IVF VD	Stayed long at home 3.4Kg	5-6	15	5	Yes	HIE
	19y			c 115-119	IVF, LLT, CS DELAY 3.5Kg	Major delay CS as family trying obtain materials	3-5	NR	2	No	Severe BA
	30y		5c		VD	Meconium 2.9Kg	3-5	10	9	NR	Severe BA
	41y		2c	C118-119	IVF VD	3.6Kg		5	7	No	Severe BA
	22y		8c		VD severe exhaustion	2.9Kg	3-6	NR	0	No	Severe BA
	NR		6c		VD	2.8Kg	4-6	6	Yes	yes	HIE
	19y		5c	c 100-189	VD	2.7Kg	3-5	4	3	No	Severe BA
	36y		2c		IVF D50 VD	1.8Kg	3-5	NR	8	No	Severe BA
	38y			4c 116-119	VD	2.1Kg		3	4	No	Severe BA
	22y		5c		IVF D50 VD	3.1Kg		3	8	No	Severe BA
	26y		3c	4c 110-118	VD	3.2Kg		5	16	Yes	HIE every 25 for 4h
	19y		3c	4c 160-176	LLT, IVF. CS	2.7Kg preterm	4-6	7	4	No	Severe BA
	21y			c115-119	IVF, birthing chair VD	3.2Kg		2	5	No	Severe BA
	25y			2c118-119	Arrive home LLT,IVF,CS	3.1Kg	4-6	NR	5	Yes	HIE
	16y			4c 117-119	Arrive fully IVF,D50 VD	Birthing chair 3.3Kg		6	6	No	Severe BA
	39y		3c	C114-119	Arrive fully IVF,D50 VD	APH, placenta praevia 1.6Kg		3	9	Yes	HIE
	27y		2c	C 110	LLT,IVF,D50, **CS**	Cord entangled		4	7	No	Severe BA
	21y		12c	2c 116-121	**IVF VD**	2.6Kg	4-5	5	8	NR	Severe BA

MTMH Apgar scores of 5 or 6 at 5minutes (all survived and went home) *2 of 2 analyses*

Hospital	Age yrs	N:	FHR normal	FHR abnormal C = contractions	ACTIONS Mode of Delivery	Any obstetric disorder. Yes/No If yes describe	Apgar 1-5	Neo resus min?	NICU days	Seizures	Presence of BA
MTMH 2	20y	65	10c		VD	2.5Kg		3	6	No	Severe BA
	24y			3c105-119	LLT,IVF, D50, VD	Long stay home		3	7	No	Severe BA
	31y		5c	9c116-120	LLT,IVF, VD			2	4	NO	Severe BA
	19y		6c	2c 107	LLT,IVF, D50, VD	2.7Kg		4	7	NO	Severe BA
	16y			5c 105-108	LLT,IVF, CS	Obstructed labour 3.3Kg		10	7	NO	Severe BA
	28y		3c	4c 106-112	LLT, IVF, MgSO4, CS	Convulsion in clinic Unconscious at home 1.5Kg		6	18	Yes	HIE
	34y			4c 106-108	VD	2.4Kg		2	23	Yes	HIE
	17y		11c	6x	VD	3.0Kg	4-6	6	6	No	Severe BA
	29y		8c	6c 170 161,117	LLT, IVF,CS	3.0Kg		6	6	NO	Severe BA
	17y		11c	7c 108-120	IVF, push, VD	Fully dilated 2.8Kg		6	6	NO	Severe BA
	17y			4c 107-110	LLT,IVF, ARM, VD	3.3Kg Stayed home long		5	6	NO	Severe BA
	22y		7c	4c 109-120		3.0Kg	5-6	3	6	No	Severe BA
	14y			2c 102-107	LLT,IVF CS	From home Cord prolapse 2.7Kg FHR in CS 165-198		10	12	Yes	HIE
	43y		3c	2c XX	CS Arrest descent	Previous CS	4-6	3	6	No	Severe BA
	17y			4c 98-106	LLT,IVF, VD	3.0Kg		2	3	No	Severe BA
	16y			4c 90-107	VD	Breech 2.9Kg		3	7	No	Severe BA
	NR			5c 100-110	VD	3.8		15	5	Yes	HIE
	27y			5c 100-109	IVF VD	3.0Kg		2	5	No	Severe BA
	37y			3c 101-114	LLT,IVF, D50, VD	4Kg		5	6	No	Severe BA
	24y		17c	5c 106-114	IVF, push VD	3.4Kg		10	7	No	Severe BA
	NR		17c	5c 187-195	CS	Preeclampsia, twins 2.3Kg		7	5	No	Severe BA
	18y		5c	4c 118-120	Cannot push **Vacuum**	2.8Kg		4	3	No	Severe BA
	33y		13c	6c X	VD	3.6Kg		3	8	No	Severe BA
	32y		18c	4c 108-117	IVF, push VD	Meconium 2.9Kg		10	7	No	Severe BA
	19y		11c	11c 103-117	IVF, oxytocin, VD	Unable to push		20	9	Yes	HIE
	30y		18c	4c 101-111	IVF, oxytocin, VD	Encourage push 3.1Kg		12	6	No	Severe BA
	16y		15c	3c 168-197	IVF **vacuum**	Unable push, Meconium, 2.7Kg		6	6	No	Severe BA
	26y		6c	5c 106-111	IVF, VD	2.9Kg		5	6	No	Severe BA
	16y		1c	2c 100-110	LLT, IVF, VD	Fully encourage push 3.3Kg		8	9	No	Severe BA
	22y		4c		Fully dilated push VD	From home 3.1Kg Meconium		6	4	No	Severe BA
	20y		11c		VD	Prolonged labour couldn't push 2.0Kg		3	8	No	Severe BA
	20y		4c		VD	3Kg		3	6	No	Severe BA
	15y			2c 107-109	LLT,IVF, D50, VD	Stayed long at home 2.9Kg		7	8	No	Severe BA
	15y		6c	2c 109-100	VD	Couldn't push meconium 2.9Kg		5	7	No	Severe BA
	30y		5c		VD	Couldn't push 3.4Kg		7	3	No	Severe BA

CB Dunbar Apgar scores of 5 or 6 at 5minutes (all survived and went home) *1 of 2 analyses*

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Hospital	Age yrs	N:	FHR normal	FHR abnormal C = contractions	ACTIONS Mode of Delivery	Any obstetric disorder. Yes/No If yes describe	Apgar 1-5	Neonatal resus min?	NICU Admit days	Seizures in NICU	Presence of BA
CBD	25y	45	1c		VD	Mum refused after 1 con Then MW and OBC 2.8Kg	4-6	Yes	Yes	No	Severe BA
1	19y			20c 105	D50 **Vacuum**	Fully dilated 10cm poor efforts 2.4Kg	5-6	5-10	Yes	No	Severe BA
	21y		44c		VD Episiot.Refused push	Fully dilated Exhausted	4-6	5-10	Yes	No	Severe BA
	26y		33c		CS Obstructed labour		4-6	4	Yes	No	Severe BA
	17y			36c 102	IVF, O2, **Vacuum**		4-6	5	5	No	Severe BA
	28y			26c 100	IVF, Episiotomy, VD	Fully dilated Head +3, caput,	3-6	2	Yes	No	Severe BA
	15y			31c 116	D50, O2, Episiot, VD	Fully dilated	3-5	3	Yes	No	Severe BA
	21y			27c 100	IVF Episiotomy VD	Fully dilated rapid delivery	3-5	10	Yes	No	Severe BA
	18y			27c 100	IVF, VD	Fully dilated rapid delivery	3-5	10	Yes	No	Severe BA
	17y			26c 100	VD, IVF, Episiotomy	Fully dilated rapid delivery	5-6	8	7	No	Severe BA
	NR			38c 90	IVF, D50, vacuum	Prolonged 2nd stage	3-5	3	5	No	Severe BA
	23y		42c		CS	Previous CS and failure to progress	3-6	2	10	No	Severe BA
	28y			36c 109	D50, O2,, VD	Fully dilated Quick delivery	3-5	5	14	No	Severe BA
	35y			39c 100, 90	D50, IVF O2,, VD	Difficult VD by OBC	3-5	15	7	No	Severe BA
	23y			1c 136	CS	Twins Cord prolapse First twin	4-6	6	4	No	Severe BA
	34y		??	1c 109	D50, O2,, CS	On admission 109 by OBC Breech	4-6	3	5	No	Severe BA
	17y			NR	CS Eclampsia	Monitored only by nurse aid	4-6	7	5	No	Severe BA
	17y		1c 120	16-17c 171	D50, IVF O2,, CS	Obstructed labour Delay 1 h 30 mins as OR busy	2-6	19	2	No	Severe BA
	15y		NR	Immediate CS	Immediate CS	From home Eclampsia	3-5	5	Yes	no	Severe BA
	20y		27c		D50, IVF O2,, VD Epis.	Given bag of water Poor pushing	3-5	10	yes	No	Severe BA
	21y		MW		VD	Mum refused Standard MW monitoring	3-6	3	2	No	Severe BA
	17y			34cX	VD	FHR fell on delivery bed whilst pushing	3-5	5	7	No	Severe BA
	24y		MW		8cm dilated VD	Mum refused. Standard MW monitoring	3-5	8	yes	No	Severe BA
	22y		43c		VD		3-6	6	Yes	No	Severe BA
	30y			38c 100	LLT, Quick delivery VD	Fully dilated	5-6	2	9	No	Severe BA
	23y		43c		VD	Preterm 1.4Kg	4-6	2	9	No	Severe BA
	26y			31c 116	VD	Fully dilated	4-6	7	yes	No	Severe BA

CB Dunbar Apgar scores of 5 or 6 at 5minutes (all survived and went home) *2 of 2 analyses*

Hospital	Age yrs	N:	FHR normal	FHR abnormal C = contractions	ACTIONS Mode of Delivery	Any obstetric disorder. Yes/No If yes describe	Apgar 1-5	Neonatal resus min?	NICU Admit days	Seizures in NICU	Presence of BA
CBD 2	33y	46	2c 129		VD	Twins Fully dilated 1st Aps 8-10 2nd needed resus	3-5	15	6	No	Severe BA 2490
	19y			35c 100-106	LLT, IVF, O2, VD	Rapid delivery	4-6	4	8	No	Severe BA 2492
	18y			1c 105	VD	Rapid delivery	4-6	5	5	No	Severe BA
	17y		1c		VD	Came in fully dilated 1.1Kg	3-5	6	Yes	No	Severe BA
	19y		33c	Then 115	VD episiotomy	Came in fully dilated	4-6	5	1	No	Severe BA
	17y		None		CS for obstructed labour	Referred Phebe H Fetal distress Breech	3-5	4	6	No	Severe BA
	15y		None		Vacuum unable to push	Arrive fully dilated eclampsia	4-6	8	19	No	Severe BA
	23y		55c	Then 113	VD	During delivery	3-5	4	??	No	Severe BA
	22y		49c	Then 105	VD rapid delivery	During delivery	5-6	2	Yes	no	Severe BA
	15y			1c 179	VD OBC quick delivery	During delivery	3-6	11	18	No	Severe BA
	13y		1c 120		VD	Preterm 1.8Kg	4-6	6	18	No	Severe BA
	24y		56c		VD		3-5	22	Yes	Yes	HIE
	18y			1c 166	IVF VD	Fully dilated prolonged labour	4-6	??	Yes	Yes	HIE
	23y		50c		VD	Obstetric details?	4-6	5	Yes	No	Severe BA
	30y		1c		VD	Fully dilated on arrival	4-5	4	??	No	Severe BA
	31y		1c 138		Emergency CS	2 previous CS 2.5Kg	5-6	6	??	No	Severe BA
	17y		1c 130		CS	Obstructed labour CPD and Malpresentation?	2-6	9	Yes	No	Severe BA
	25y		1c 147		CS Fully dilated	Due to obstructed labour CPD	4-6	8	Yes	No	Severe BA
	20y		43c		VD		4-6	5	Yes	No	Severe BA

Comments: 17 no change FHR, 24 changes in FHR; 6 =not monitored.
1 breech; 3 eclampsia; 1 previous CS; 2 ;poor push ; 4 obstructed labour; 1 cord prolapse twin;1 twin; 6 episiotomy; 1 exhausted; delay 1.5 hours for CS as OR full; 4 prolonged labour fail progress; 5 LBW.

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Clinical data on mothers and babies where 5-minute Apgar 7 or more and no changes in FHR monitoring in labour (all infants survived and were discharged home)

Hospital	N enrolled mothers (excluding FIUDs)	N no change FHR
CB Dunbar	3360	3240
MTMH	1781	1493
Lofa (T)	932	873
Sinje	325	268
TOTALS	**6398 (6288 excluding IUFDs)**	**5874 (93%)** Apgar 10 =5556 (95%)

Clinical data on mothers and babies where 5-minute Apgar 7 or more and with changes in FHR monitoring in labour (all infants survived and were discharged home)

Hospital	N enrolled mothers (excluding FIUDs)	N with change in FHR
CB Dunbar	3360	144
MTMH	1781	163
Lofa (T)	932	26
Sinje	325	14
TOTALS	**6398 (6288 excluding IUFDs))**	**347 (6%)** Apgar 10 = 137 (39%)

Clinical data on mothers and babies where 5-minute Apgar 7 or more and with changes in FHR (all neonates survived and were discharged home)

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Hospital	N change FHR Slow Fast NR	N Resus	N Apgar 7	N Apgar 8	N Apgar 9	N Apgar 10	Obstetric issues	Fast Slow FHR	Age <18 y	Age > 34 y	Birth asphyxia status
CB Dunbar	144	70	28	40	8	68	47 VD; 86 CS; 11 Vacuum 3 Material/drug/blood/IVF delay ; 1 breech; 3 cord (1 prolapse, 1 v. short, 1 3cord tangle); 2 preeclampsia; 1 APH; 11 prol lab; 5 obstruct lab; 2 malaria; 1 difficult VD; 6 previous CS (3x1, 2x2, 1x3); 7 episiotomy; 3 twin (1 ISB); 2 poor effort; 1 infected meconium; 9 LBW	Fast 19* Slow 117 NR = 8 * 2 high to low rates	15 14yr = 1 15yr = 1 16yr = 5 17yr = 8	13 (35-42)	NOBA = 71 Mild BA = 45 BA = 28
MTMH	163	135 27 no resus 1 NR	46	68	8	41	97 VD; 64 CS (2 unsure); 2 vacuum 6 material/drug/blood/IVF delay; 11 breech; 1 cord prolapse; 6 cord tangles; 4 eclampsia; 4 APH (2 beeding 1 praevia); 12 prolonged labour; 5 obstructed labour; 1 malaria; 1 severe anaemia; 1 retained 2nd twin; 4 twins; 3 post date; 2 fail induction; 5 previous CS (1 x2, 1 x3); 2 face presentation; 13 LBW; 3 long distance;	Fast = 10 Slow = 145 Unsure XX not figures =8	18 15yr = 1 16 yr =6 17yr=11	27 1 aged 50	NOBA = 22 Mild BA =92 BA = 47 HIE = 2
Lofa (T)	26	13	4	2	0	20	8VD; 17CS; 1 vacuum; 1 breech; 1 transverse; 7 Obs lab /CPD; 2 Prev CS; 1 Cord tangle; 90 Epis; 1 Abruption; 1 severe PE;5 Prol lab; 1 Fail push; 1 twin; 2 malaria; 1 LBW;	Fast = 1 Slow = 25	1 = 17y	12 (37y)	NOBA =13 Mild BA = 9 BA =4
Sinje	14	9	0	6		8	5 VD; 7 CS; 2 Vac; 4 Fully; 1 cord; 1LBW; 2 Obs Lab; 2 Prev CS; 1 malaria; 1severe PET; 1abruption	Fast = 0 Slow 14			NOBA = 5 Mild BA = 9
TOTALS	**347**	**227 65.4%**	**78 22.5%**	**116 33.4%**	**16 4.6%**	**137 39.5%**	**VD = 157 (45.2%) CS = 174 (50.1%) Vacuum = 16 (4.6%)**	**Fast = 30 (8.6%) Slow = 301 (86.7%)**	**34 (9.8%)**	**52 (15.0%)**	**NOBA = 111 (32.0%) Mild BA = 155 (44.7%) BA = 79 (22.8%) HIE = 2**

Clinical data on mothers where 5-minute Apgar 7 or more and no changes in FHR monitoring in labour

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Hospital	N no change FHR	N Resus	N Apgar 7	N Apgar 8	N Apgar 9	N Apgar 10	Obstetric issues Details available on request	Age <18 y	Age > 34 y	Birth asphyxia status
CB Dunbar	3240	78 (27NR)	21	83	46	3086	VD = 2736 CS = 472 Vacuum = 29	319	300	63 mild BA 20 BA
MTMH	1493	76 (4NR)	19	45	31	1377	VD = 1266 CS = 212 Vacuum = 6	125	192	61 mild BA 16 BA 1 HIE
Lofa (T)	873	46	4	16	12	841	149 CS; 712 VD; 12 Vac.	82	79 10 age NR	4 BA 44 mild BA
Sinje	268	14 (1NR)	5	4	7	252	30CS; 234VD; 4 Vac;	11 (214 NR)	4	5 BA 12 mild BA 251 NOBA
TOTALS	**5874 92%**	**214 36.4%**	**49 0.8%**	**148 25.2%**	**96 16.3%**	**5556 94.6%**	**VD = 4948 (84.2%) CS = 863 (14.7%) Vacuum = 51 (0.9%)**	**537 9.1%**	**575 9.8%**	**HIE = 1 BA = 45 (0.8%) Mild BA = 180 (3.1%)**

Comments made by mothers following the monitoring of their unborn babies in one of the 4 hospitals

CB Dunbar Hospital: total births (from Nov 2018- Feb 2023)= 3,471.

No negative comments.

350 mothers did not comment. Reasons given were:

- delivery very soon after monitoring started
- “too much pain”
- IUFD or stillbirth in a few cases.

Comments made by mothers following the monitoring of their unborn babies: 1 Young mothers < 18 years

Maternal age in years at births	Additional information	Mothers' words
15y	Vacuum for prolonged 2nd stage. Apgar 7,10	My stomach was hurting me but I was listening to my baby heart sound. Your thank you.
16y	VD Apgar 9,10	It was fine for me to listen to my own baby. Th only thing that was giving me hard time was the pain
17y	VD Apgar 8,10	The power of God is great. I was able to check my unborn baby heart beat. No problem, my baby is normal. Thank God for the power that he give me.
16y	VD Apgar 9,10	I felt fine checking my baby. Thanks God for the power giving me to check my baby and my baby is save.
14y	VD Apgar 8,10	I thank God so much he making me strong doing my monitoring thank for my baby life. This new program is very good even though it can difficult at the end
16y	VD Apgar 9,10	I am so happy for the power God give me to monitor my baby heart beat and thanks to the midwife and head of this program. My baby is save and fine.

Comments made by mothers following the monitoring of their unborn babies: 2. Babies born with low Apgar scores

Maternal age in years at births	Additional information	Mothers' words
21y	Pre term breech VD Apgar 1,2	The monitoring help me in labour. It never cause me any harm. I monitoring and I make that it is normal. It did not cause me any problem.
35y	VD following change in FHR. Apgar 4,7	I see the baby breathing program to be very good one. I say it good because the time my baby was not breathing good I call the doctor woman and tell her that the way the thing was sounding it's not sounding like that again and they help me.
21y	Quick VD following change in FHR. Apgar 3,5	I see the monitoring to be very good. It was a great experience to have my baby monitor. It help me because I knew my baby was living and I will carry my baby home. It don't cause any problem for me.
17y	CS for obstructed labour. Apgar 5,7	I feel good about listening to my baby breathing while it was in my stomach. It helps me a lot because I stay long in pain but when my baby breathing pattern start to change the midwife and doctor were informed and they did what they could to help me
28y	NVD Episiotomy. Apgar 3,6	I thankful to God for the monitoring it help me. I listen to my unborn baby heart beat it make me happy and I have my baby with me even though my baby did not cry right away but I saw my baby on the baby ward and he is doing well
20y	CS Apgar 5,7	I want to tell God thankyou. I was able to listen to my own baby heart beat. When the pain was getting strong I was not able again. But I am happy for my baby my baby is alive. And thankyou for all the help

Comments made by mothers following the monitoring of their unborn babies: 3. Supportive role of midwives

Maternal age in years at births	Additional information	Mothers' words
18y	VD Apgar 8,10	It was fine doing this but I was very uncomfortable. I continue it because you was talking to me
24y	VD Apgar 9,10	It hard to do because the pain not easy my stomach was hurting bad way but since you talking to me that why I do it. But it not bad that good thing.
29y	VD Apgar 8,10	During my labour I was told to do my baby heart beat I was able to listen to the midwife and i have my baby with me. Thank God I was able with all the pain
35y	VD Apgar 8,10	Many thanks to the midwives for listening to me they provide care for me. The monitoring was good it help me feel closer to my baby
32y	CS Apgar 9,10	I enjoy the monitoring, it was fine at first but there was too much pain for me. I tell the midwife. Thank all I have my baby with me
16y	VD Apgar 8,10	I thank God for the mid wife and the cares that they give me that make to know how to check my baby heart beat. My baby and I are doing good.

Training as part of task-sharing program

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1. Obstetric clinicians: n = 28

19 fully qualified after 3 years of training (one RIP)
9 new trainees started August 2020 due to qualify September 2023

Trainers: Dr Harris, Dr Marsalley, Dr M Casement, Dr D Watson, Dr B Hayden, Dr K Hinshaw, Prof D Southall, Mrs K Borzoi, Jefferson Doe, Nehwon Wameh

2. Neonatal clinicians n = 16

3 fully qualified after 2 years of training (1 left program for USA)
5 (completed training and qualified in January 2021) (1 left program for Netherlands for an international MPH course against advice)
8 new trainees qualified September 2022 (4 with distinction)

Trainers: A. Kola, Dr A Earley, Dr A Duthie, Prof N. McIntosh, Dr Barbara Phillips, Prof D Southall

CB Dunbar Hospital Obstetric Procedures 2020-2022 (including July 2022)

	2020	2021	2022 (up to end of July)
Total Obstetric Operations	253	514	347
Caesarean section	241	488	322
Ruptured Ectopic Pregnancy	6	12	12
Ruptured uterus	3	11	8
Hysterectomy	1	0	0
Other	2 - EOU	3 - EOU	5 (PPH)
Lead Surgeon: Doctor	123 (49%)	203 (39%)	126 (36%)
Lead Surgeon: Obstetric Clinician	130 (51%)	311 (61%)	221 (64%)
Maternal Death	0	0	0
Neonatal/Fetal Death	18	47	22

Note increasing proportion of major obstetric surgery undertaken by Obstetric Clinicians from 2020 to 2022

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

- A need for more clinicians trained in diagnosing and treating pregnancy and delivery complications was recognised following a countrywide assessment of health facilities (WHO and Irish Aid). This need was especially recognised in the rural areas of Liberia and instigated training of midwives in advanced obstetric skills.
- Once qualified after 3 years of 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.
- 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, blood tests when appropriate, and obstetric ultrasound scan.
- Women attending these community outreach clinics live in remote areas and, for socioeconomic reasons, cannot reliably attend central clinics or reach hospital in time once labour begins.

High risk categories identified at outreach include

- Medical conditions: for example, malnutrition, diabetes and heart conditions
- Obstetric conditions: for example, hypertensive disorders, infections
- Maternal age:< 18yrs and > 39yrs
- Grand multiparity
- Multiple pregnancy
- Malpresentations
- Abnormal placentation, for example placenta praevia
- Post maturity by women's dates and evidence on USS

Until obstetric clinicians began visiting there had been no ultrasound facilities in remote clinics. This development means that pregnant women can see their fetus for the first time. Ultrasound scanning adds to the clinical diagnosis of high-risk pregnancies and can reveal potentially life-threatening disorders (for example placenta pathology, malpresentations such as transverse lie, unrecognised intrauterine fetal death) and help manage them before there are tragic consequences.

Planning for birth following obstetric outreach clinics

Breech 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.

- The obstetric clinician 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 term in case of complications needing an urgent Caesarean section (for example 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 home before delivery if they do not know anyone living close to the hospital and cannot afford to pay for accommodation.

Outreach clinic visits in Grand Gedeh County from base at Martha Tubman Memorial Hospital (MTMH) August 2021-June 2022

DRAFT

Date	No. of clinics	Women assessed	Women identified as high-risk
2021 – August	3	44	27
September	3	69	46
October	3	61	39
November	3	35	12
December	4	20	5
2022 - January	3	33	14
March	4	156	65
April	3	47	20
May	3	50	24
June	3	46	16
Totals	**32**	**561**	**268**