Empowering mothers by their involvement in monitoring the Fetal Heart Rates (FHR) of their unborn babies during labour in Liberia.

Project location: Initially in 4 rural counties in Liberia: Grand-Gedeh, Lofa, Grand-Capemount and Bong County ***:*** July 2017 to December 2022. MacDonald *et al. BMC Pregnancy and Childbirth* (2026) 26:564

Extension and current program is now being undertaken (January 2023 to October 2026) in 6 counties: Includes Margibi and Sinoe, in addition to the 4 counties above,

Ethics approval and consent to participate

This program is part of the National Task Sharing program of Ministry of Health Republic of Liberia. The Pilot study was approved by the National Research Ethics Board (NREB) of Liberia through a full board review. The federal wide assurance number of the NREB is 00021658 and the organisation number is 0008374.

Background 1

- Several studies from African countries have emphasised that FHR monitoring and completion of partographs to international or locally adapted standards of intrapartum care are not being achieved.

- One reason is the understaffing of maternity units in low -resource settings, reflecting widespread poverty and poor workforce planning with poor remuneration for nurses compared with doctors.

- Particularly relevant in Tanzania was that FHR monitoring was poor with the average FHR only being monitored every 105 minutes instead of the locally recommended 60 minutes and the WHO recommended 30 to 60 minutes in Stage 1 of labour

Background 2

- Maternal exhaustion and absent pain control during labour is prevalent in Liberia.

- There is absence of any pain control in labour for most mothers in Liberia and the resulting severe pain interfered with monitoring for fetal distress. Introduction of intravenous paracetamol during labour into 2 hospitals has been effective and helped mothers to be able to comply with monitoring.

- This program confirmed that mothers were willing to take part and found it helpful, empowering and supportive but some mothers became too exhausted to monitor the FHR. Exhaustion and ketoacidosis can have a deleterious effect when fetal distress is detected in the second stage of labour and can reduce the effectiveness of the mother being able to contribute to “pushing out” the baby. The immediate availability of vacuum delivery was critical here in delivering the baby rapidly and in minimising the need for Caesarean birth.

Background 3

- Liberia has one of the lowest numbers of healthcare workers in the world, and following armed conflict and the Ebola crisis, the shortage of doctors and nurses, especially in rural areas, became severe. At night one nurse or midwife might be working alone caring for many mothers in labour and unable to complete partographs according to WHO recommendations leading to delays in identifying fetal distress.

- There is also extreme poverty, so that people cannot afford to pay for healthcare. There are frequent shortages of emergency drugs and other supplies in public hospitals leading to delays in the management of obstetric emergencies which can result in fetal distress.

Methods 1

- Mothers gave their consent after explanation of the study and being shown the form that they would be asked to complete in partnership with maternity staff.
- Mothers were taught by “nurse aids” or maternity staff to listen to their unborn baby’s heart rates at the end of **every** consecutive uterine contraction for 30 to 60 seconds, using a battery-operated doppler ultrasound probe (SonicAid)
- This was possible, although more difficult, when admission had occurred and monitoring had started in the second stage of labour.
- Sometimes the first recorded FHR abnormality was identified on admission, suggesting that fetal distress had been present for some time

Methods 2

- Although volunteer qualified nurse-aids, trained mothers to identify changes/abnormalities in FHR, they were not responsible for responding clinically and immediately referred suspected changes to the maternity staff present. There was no increase in Ministry of Health (MOH) funded midwives, obstetric clinicians or doctors.

- This shows the potential for the use of this form of task-sharing wherever low staffing levels threaten good maternity care. For example, our recent publication from Ukraine, a country with armed conflict for the last 4 years, reported that FHR monitoring by mothers was helpful where normal services were disrupted by conflict, and staffing levels lower than usual.

To help in the care of my baby during labour I agree to complete this form (signature) .....

Fetal Heart Rate Monitoring

Mother's Name .....

Date/Time: ..... **Case record**....

Nu	Norm ✓	Changed X	Confirmed	
1		Time	Time	
		Faster	Yes	No
		Slower		
2		Time	Time	
		Faster	Yes	No
		Slower		
3		Time	Time	
		Faster	Yes	No
		Slower		
4		Time	Time	
		Faster	Yes	No
		Slower		
5		Time	Time	
		Faster	Yes	No
		Slower		
6		Time	Time	
		Faster	Yes	No
		Slower		
7		Time	Time	
		Faster	Yes	No
		Slower		
8		Time	Time	
		Faster	Yes	No
		Slower		
9		Time	Time	
		Faster	Yes	No
		Slower		
10		Time	Time	
		Faster	Yes	No
		Slower		
11		Time	Time	
		Faster	Yes	No
		Slower		
12		Time	Time	
		Faster	Yes	No
		Slower		
13		Time	Time	
		Faster	Yes	No
		Slower		
14		Time	Time	
		Faster	Yes	No
		Slower		
15		Time	Time	
		Faster	Yes	No
		Slower		
16		Time	Time	
		Faster	Yes	No
		Slower		
17		Time	Time	
		Faster	Yes	No
		Slower		
18		Time	Time	
		Faster	Yes	No
		Slower		

Meconium present YES / NO

Nu	Norm ✓	Changed X	Confirmed	
19		Time	Time	
		Faster	Yes	No
		Slower		
20		Time	Time	
		Faster	Yes	No
		Slower		
21		Time	Time	
		Faster	Yes	No
		Slower		
22		Time	Time	
		Faster	Yes	No
		Slower		
23		Time	Time	
		Faster	Yes	No
		Slower		
24		Time	Time	
		Faster	Yes	No
		Slower		
25		Time	Time	
		Faster	Yes	No
		Slower		
26		Time	Time	
		Faster	Yes	No
		Slower		
27		Time	Time	
		Faster	Yes	No
		Slower		
28		Time	Time	
		Faster	Yes	No
		Slower		
29		Time	Time	
		Faster	Yes	No
		Slower		
30		Time	Time	
		Faster	Yes	No
		Slower		
31		Time	Time	
		Faster	Yes	No
		Slower		
32		Time	Time	
		Faster	Yes	No
		Slower		
33		Time	Time	
		Faster	Yes	No
		Slower		
34		Time	Time	
		Faster	Yes	No
		Slower		
35		Time	Time	
		Faster	Yes	No
		Slower		
36		Time	Time	
		Faster	Yes	No
		Slower		

Actions if FHR change confirmed

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Nu	Norm ✓	Changed X	Confirmed	
37		Time	Time	
		Faster	Yes	No
		Slower		
38		Time	Time	
		Faster	Yes	No
		Slower		
39		Time	Time	
		Faster	Yes	No
		Slower		
40		Time	Time	
		Faster	Yes	No
		Slower		
41		Time	Time	
		Faster	Yes	No
		Slower		
42		Time	Time	
		Faster	Yes	No
		Slower		
43		Time	Time	
		Faster	Yes	No
		Slower		
44		Time	Time	
		Faster	Yes	No
		Slower		
45		Time	Time	
		Faster	Yes	No
		Slower		
46		Time	Time	
		Faster	Yes	No
		Slower		
47		Time	Time	
		Faster	Yes	No
		Slower		
48		Time	Time	
		Faster	Yes	No
		Slower		
49		Time	Time	
		Faster	Yes	No
		Slower		
50		Time	Time	
		Faster	Yes	No
		Slower		
51		Time	Time	
		Faster	Yes	No
		Slower		
52		Time	Time	
		Faster	Yes	No
		Slower		
53		Time	Time	
		Faster	Yes	No
		Slower		
54		Time	Time	
		Faster	Yes	No
		Slower		

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Form for mother and staff to enter any changes detected in FHR occurring during the 30 to 60 second time periods immediately after every uterine contraction

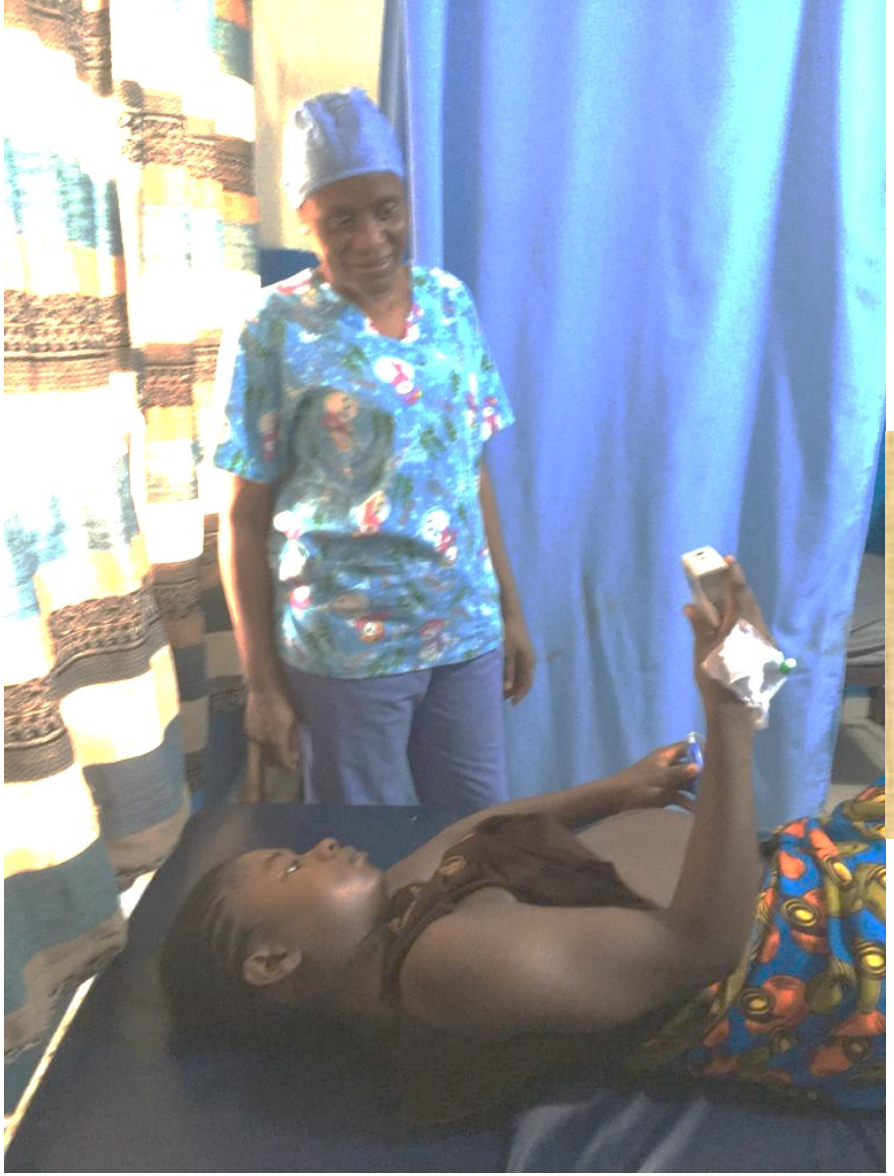
MOTHER NAME..... AGE..... CASE RECORD NUMBER..... HOSPITAL.....

Date/time of delivery..... Monitoring by mother ☐ Yes ☐ No ☐ Partial

FETAL MONITORING PROJECT DATA

Maternal data (please, CIRCLE everything related)	Neonatal data (please, CIRCLE everything related)
1. **Gravida and Parity: .....** 2. **Pregnancy**: Single / Multiple 3. If multiple, birth number: ..... 4. Fetal position (1st): Vertex/ Breech / Transverse 5. Uterine scar: No / Previous CS / Uterine surgery 6. **Maternal disease**: Chronic hypertension / Chronic renal diseases / Heart diseases decompensated / Urinary tract infections in pregnancy / Diabetes mellitus / Gestational diabetes / Acute respiratory syndrome at delivery / Trauma / Other..... 7. **Date/Time** admission for delivery ..... 8. Cervical dilatation on admission ..... 9. Stage of labour on admission: Latent/Active/2 stage 10. **Pregnancy / delivery complications**: Placenta Previa / Placenta abruption / Uterus rupture / PROM>24h / Chorioamnionitis / Antepartum Haemorrhage / BP drop / Preeclampsia severe / Eclampsia / Fetal growth retardation / Cord prolapse / Inadequate contractions or dilatation / Obstructed labour / Fetal distress / Shoulder dystocia / PPH <1000 ml / PPH ≥1000 ml / Other: ..... 16. **FHR changed detected by mother**: No/Yes 17. If Yes, time of detection: ..... 18. Type of changes: Faster / Slower 19. FHR change confirmed by health-worker: No / Yes 20. If partial monitoring why did midwife/OBC/Dr take over ..... And approximately how much time of her labour did mother spend undertaking the monitoring .....percent 21. **Suspicious FHR confirmed**: No/Yes 22. If Yes, time confirmed: ..... 23. Who confirmed FHR problem: MW/OBC/DR 24. Type of FHR change confirmed clinically: Decelerations / Bradycardia / Tachycardia 25. **Meconium present** No/Yes 26. **Actions taken**: Lateral tilt / IV fluid / 50% glucose/ Stop Oxytocin / O_2 / Vacuum / Forceps / Caesarean Section 26. **Delivery interventions**: Labour induction / Labour augmentation / Spinal anaesthesia for CS/ General anaesthesia for CS 27.**Delivery**: Spontaneous vaginal / Vacuum / Caesarean Section 28.**Vacuum indication**: Suspicious FHR/ Other: describe..... 29.**Caesarean Section indication**: Maternal request / Elective CS/ Emergency CS FHR not related / Emergency CS FHR related 30. **Mother**: Alive / Died 31. **Mother condition on** Discharge: Well / Complications needing follow-up	1. Date of birth..... 2. Time of birth..... 3. Sex: Boy / Girl 4. Weight at birth Kg. ..... 5. Hospital No of baby: ..... 6. If multiple, sequence number ..... 7. If multiple, type of birth: Spontaneous vaginal / Vacuum / Forceps / Cesarean Section 8. Baby alive at delivery: No / Yes 9. Resuscitation: No / Yes 10. Resuscitation: Bag & Mask / Chest compressions / Drugs..... 11. Duration of Resuscitation in minutes: ..... 12. Apgar 1 min ..... 13. Apgar 5 min ..... 14. Apgar 10 min ..... 15. Apgar at end of resuscitation ..... 16. Admission to neonatal ward: No / Yes (if No - to 25) 17. Indications for neonatal ward: Birth Asphyxia / Respiratory Failure/ Prematurity / Infection / Others, specify:..... 18. Seizures/fits: No / Yes 19. Baby: Alive / Died 20. If alive date of discharge..... 21. Condition on discharge Well / Complications needing follow-up 22. If died date of death ..... 23. If death: age of baby at death (days/hours) ..... 24. Cause of death: Asphyxia / Complications of prematurity / Infection / Congenital anomaly / Respiratory failure / Tetanus/ Others: specify..... **Comments on self FHR monitoring** 1. Mother's comments on FHR: Excellent experience (1) / Good experience (2) / Alright experience (3) / Poor experience (4) / Very bad experience (5) 2. Problems with self-FHR monitoring: No / Yes 3. If Problem, specify: ..... Mother's comments on her experience in exactly her own words: **Medical worker who filled out the form** .....

Data form completed by midwife, obstetric clinician, or doctor managing labour and delivery



Mrs. Korpo Borzoi, the national lead obstetric clinician for this program and supervisor for maternity at CB Dunbar Hospital having just consented and trained a mother in how to use the obstetric ultrasound probe and record the data

Results 1

- Our data showed that mothers recording FHRs in labour could work with maternity staff to reduce perinatal mortality and morbidity by intervening when abnormalities or changes occurred

- A direct comparison with the previous study in Liberia in 2014, showed an 11.6 times higher intrapartum stillbirth rate (2.2% versus 0.19%) than was identified in this study.

- The same is true for early neonatal deaths. In the study reported in 2014 from Liberia, early neonatal deaths occurred in 53/1656 (3.2%): 7.1 times higher than this study where 29 early neonatal deaths occurred in 6432 live births (0.45%).

- Intrapartum stillbirth rate and neonatal death rates are also lower than figures reported from other low resource countries

Results 2 Historical data

Source of data	No: patients studied	Intrapartum stillbirths	Neonatal deaths	Apgar scores at 5 mins of 1-2	Apgar scores at 5 min of 3-4
Current Liberian program 2024	6444	12 0.19%	31 0.48%	16 0.25%	43 0.67%
Previous Liberian program 2014	1656	37 2.23%	53 3.2%		
Ghana 2019	200	12 6.0%			27 13%
Nigeria 2012	864		229 26.5%		
Ethiopia 2020	2013	13 3.1%			
Nepal 2016	4476	136 0.53%			
Tanzania 2012	5845	93 1.59%	56 died within 24 hours of birth 0.90%		
Lesotho Randomised control trial 2024	55 without maternal FHR monitoring 55 with maternal FHR monitoring	9 =16.4% 1 =1.8%	5 =1.9% 1 =1.8%	6 =10.9% 1 =1.8%	

Results 3

- For 6444 babies in this program the Hypoxic Ischaemic Injury (HIE) rate was 0.46% and the rate for all degrees of birth asphyxia was 5.28%; lower than in other low-resource countries.

- Out of 6,222 enrolled mothers whose babies had Apgar scores of 7 to 10 at 5 min, 95% without FHR changes had Apgar Scores of 10 at 5 min and for those with FHR changes only 40% of babies had Apgar scores of 10 at 5 min.

- If during monitoring there are no changes in FHR, some reassurance can be provided to mothers. Where there are FHR changes, staff can ensure that effective resuscitation and neonatal care are immediately available.

Results 4

- Changes/abnormalities in FHR were associated with more Caesarean Sections. (43.7%) than those without FHR problems (14.5%)

- The overall unassisted vaginal delivery rate was 82% and the overall Caesarean section rate was only 17%.

- More vacuum deliveries were undertaken when FHR changes were present (5.8%).

Results 5

- Fetal deaths occurring before admission to hospital could not be influenced by this program and remain unacceptably high, as in other low-resource settings. UNICEF data published in 2025 showed 48% of stillbirths in West and Central Africa occurred antepartum.

- Nine FHR abnormalities were detected in those with Apgar scores of 1 or 2 at 5 min on the first recorded FHR on admission/arrival (near stillbirths).

- Identifying fetal distress in mothers presenting in labour to community settings (clinics and waiting homes) could prevent some of these “near stillbirths”. It may be helpful to provide community staff with battery operated doppler ultrasound monitors (as used in this program) and train them to recognise abnormal FHRs following contractions.

Results 6

- Frequently in Liberia, obstetric problems associated with perinatal compromise could have been recognised earlier and more safely managed had there not been delays in reaching hospitals; poor roads, families unable to pay for transport and fuel, and lack of working ambulances. Even when mothers did arrive at hospital, there could be an absence of emergency drugs, supplies or blood for transfusion which most families are unable to afford or access.

- In one intrapartum stillbirth in our program, where FHR changes were identified, Caesarean section was delayed. This resulted from a long-standing “stock out” of drugs, including oxygen, and lack of tests for blood transfusion.

Results 7

- Previous publications have shown a relationship between low 5-min Apgar scores and poor neuro-developmental outcomes.
- Long term neurodevelopmental follow up was not undertaken in this current program for logistic and financial reasons.
- Developments following this program should include better clinical assessments of neonatal asphyxia, such as the Sarnat score.
- Long-term follow-up by experts experienced in accurately assessing child development in low resource settings should be undertaken and linked to the FHR monitoring program.

Results 8

- Our findings align with WHO's call for respectful, person-centered, maternity care and self-care interventions
- During labour and delivery in Liberia, male husbands/ partners are not allowed to be present and support mothers. Reasons given include lack of space and cultural issues.
- WHO strongly recommends that a companion of the mother's choice is available throughout labour and childbirth as currently supported in Malawi. The International Federation of Gynaecology and Obstetrics (FIGO) also recommends a second birth assistant who could be a companion
- In our parallel study during armed conflict in Ukraine, husbands and partners were helpful to mothers in collecting data on the FHR.

Results 9

Comments made by mothers regarding their undertaking of fetal heart rate monitoring during labour.

Pain was mentioned by several mothers as a barrier to continued monitoring: *“the procedure is helpful, but labour pain cannot permit me to do this” “the pain is there, it can be uncomfortable to do” “I like the thing I was doing but it was hard to do because of the pain”.* This problem led to the introduction of intravenous paracetamol in the management of labour pain (see subsequent REPORT).

Results 10 Sample of some of the maternal comments about the current program from Lofa County Hospital

- "My sister the monitoring was good because I was able to monitor my own baby heart beat to know the good heart beat and the bad heart beat. This monitoring did not cause any problem for me and my baby. It help to save my baby.
- Thanks to our big big people for this program. If this program was not available my baby would have died or something bad may have happen to me. I was to beg the big big people who came with this program to please continue because the program is really helpful to mothers who are borning babies.
- I started monitoring my babies heart beats and I was very happy of it but I could not continue because the midwife said that my second baby was not in a good position so she helped me in monitoring of my baby until I was taken to the operating room. I thanks.
- I find the monitoring very good and it help me with my labour because I am alive. It dd not cause any problem for me the only problem was my baby came out very depressed but I thank God for life. The people help me doing my labour.
- I am very grateful for the monitoring because it has brought comfort and reduces stress. It help me understand my baby heart beat. I pray that the service continue.
- Thank God that learn new thing by listening to my baby heart beat. It give me strong and made me so proud of what I was doing. I appreciate the organisation that brought such a unique program.

Total comments	Positive	Neutral	Negative	Not relevant to FHR monitoring	Too much pain to continue
125 (123 relevant to monitoring)	123	0	0	2	8

Conclusions

- Rates of intrapartum stillbirth, neonatal death and birth asphyxia were lower than in a previous report from Liberia in 2014, as well as from other low-income countries, and it is likely that including mothers in FHR monitoring contributed to the improvements identified.

- In settings where staffing levels are inadequate, FHR monitoring by mothers, can help to overcome the consequences of too few maternity staff and low levels of partograph completion.

- Mothers informed us they valued their involvement and felt empowered when able to monitor their own unborn baby's heart rate in labour.

- Earlier recognition and actions to address FHR abnormalities in mothers in labour attending community clinics, could be a valuable approach to reducing intrauterine fetal deaths before labour.