ISSN 2598-3180 (Online)
JOURNAL OF MIDWIFERY
Research and Practice
Accredited by SINTA 4th

Article

Knowledge, Clinical Practice, and Challenges of Electronic Fetal Monitoring Among Midwives at The Buea and Limbe Regional Hospitals, Southwest Region of Cameroon

Irene Limunga Efome Matike[1], Takamo peter[2,3], Tabah Ashley Mbibu[1], Seraphine Mojoko Eko[4], Ntumwil Thomas Toah[2], Aboudou Mbom Marie-Ange[2], Elong Kliuvert Metuge[2], Abdel Jelil Njouendou[4]

1Department of Nursing, Faculty of Health Sciences, University of Buea, P.O. Box 63, Buea, Cameroon

2Department of Public Health and Hygiene, Faculty of Health Sciences, University of Buea, P.O. Box 63, Buea, Cameroon.

3Department of Medical Laboratory science, Faculty of Health Sciences, University of Buea, P.O. Box 63, Buea, Cameroon.

4Department of Biomedical Science, Faculty of Health Sciences, University of Buea, P.O. Box 63, Buea, Cameroon

SUBMISSION TRACK

Recieved: March 21, 2026
Final Revision: June 25, 2026
Available Online: June 30, 2026

KEYWORDS

Knowledge, practice, Challenges, Electronic Fetal Monitoring

CORRESPONDENCE

E-mail:
takamopiero@gmail.com

A B S T R A C T

Background: Electronic fetal monitoring (EFM) is a vital tool in obstetric care, enabling continuous monitoring of fetal heart rate and maternal uterine contractions to detect fetal distress and improve pregnancy outcomes. Yet the adoption of EFM in low-resource settings remains limited. Consideration of the experiences and barriers of midwives directly concerned with EFM application is beneficial for identifying strategies for implementation. This study sought to determine the knowledge, practice and challenges faced by mid-wives regarding electronic foetal monitoring at the Buea and Limbe Regional Hospitals, South West Region of Cameroon. **Methods:** A hospital-based cross-sectional study design was conducted among 39 midwives using convenient sampling. Knowledge and challenges were assessed using structured questionnaires; 22 midwives were directly observed performing EFM using a standardized checklist. Descriptive and Multivariate logistic regression analysis were performed using Statistical Package for Social Sciences (SPSS version 26). **Results:** The mean age of the participants was 28.59±6.19. This study revealed that 20(51%) of the study participants had adequate knowledge about electronic foetal monitoring. Majority 17(78.6%) demonstrated good practice of EFM.The most commonly reported challenge to EFM was limited continuous learning opportunities of EFM 36 (92.3%). **Conclusion:** Although the midwives demonstrated adequate knowledge and practical skills, A significant knowledge-practice gap still exists among midwives. Structured hands-on training programs and continuous professional development are urgently needed to improve EFM utilization and maternal-fetal outcomes.

https://doi.org/10.25077/jom.11.1.27-37.2026
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I. INTRODUCTION

The parturition process is a significant life event with physical and psychological implications. Midwives are obligated to mitigate associated morbidity by providing evidence-based care and support to parturient women, thereby improving maternal and foetal outcomes [1]. A key tool in this endeavor is the Electronic Foetal Monitoring (EFM) device, which is externally applied to the abdomen of the woman in labor. Electronic Foetal Monitoring is a method of monitoring foetal heart rate and uterine contractions during pregnancy and labour. Ultrasound transducers are placed on the mother's abdomen to monitor foetal heart rate and a tocodynamometer is used to measure maternal uterine contractions. It alerts the Midwife of potential foetal distress characterized by abnormalities such as bradycardia or tachycardia through an audible alarm. This ensures timely interventions including cesarean sections to prevent intra-uterine hypoxia and subsequent adverse outcomes including birth asphyxia and stillbirths [2].

As per the foetal monitoring committee opinion and guidelines of the American College of Obstetricians and Gynaecologists (ACOG;2019) the foetus can be checked with the help of both internal and external means. The internal foetal monitoring technique is an invasive procedure that entails passing of a wire via the cervix and the use of electrodes on the foetal head [2]. Even though the technique is linked to enhanced monitoring than the external technique, it has the drawback of being applied in cases where membranes have been ruptured. [3]. The external fetal monitoring is a non-invasive technique of continuous or intermittent monitoring of fetal heart rate and uterine contraction patterns of the fetus and also enables detection of fetal distress in time without subjecting the mother to risks of rupturing membranes. [4,5].

Intrapartum-related asphyxia and fresh stillbirths remain excessively high in low-resource settings [6]. The World Health Organization states that as of 2020, perinatal mortality was the cause of 47% of the child mortality rate, and 2.4 million cases of neonatal mortality were reported with Sub Saharan African region having the highest burden with 74 per 1000 live births in 2020. Cameroon recorded 26 per 1000 live births [7,8]. This creates a question of whether the foetal monitoring by the midwives is being done as per the international recommendations. To improve birth outcomes, midwives are required to ensure proper use and interpretation of results. proper interpretation, and acting on the information depend on the midwives' knowledge of the EFM [9,10]. In low-resource settings like the case of Cameroon, the use of EFM is under-utilized, leading to high incidences of intrapartum-related asphyxia and stillbirths [6]. This study sought to determine the Knowledge, Practice and Challenges Faced by Midwives regarding Electronic Foetal Monitoring at the Buea and Limbe Regional Hospitals, South West Region of Cameroon.

II. METHODS

Study design and settings

A hospital-based cross-sectional study was carried out in the Buea Regional Hospital (BRH) and Limbe Regional Hospital (LRH), South West Region of Cameroon, from December 2024 to July 2025. Both hospitals are the main referral secondary care centers found in the South-West Region of Cameroon and are equipped to provide comprehensive obstetric and neonatal care. A convenient sampling method was used in this study to select the hospitals, hospital ward and participants.

Study population and sampling

The sample size was calculated using the Yamane's formula . where: **n** is the required sample size, **N** is the total population size, **e** the margin of error

$$n = \frac{N}{1+N(e)^2}$$

The estimated sample size for the study was 39 participants

Data collection

Data for this study were collected using an interviewer-administered questionnaire built using google form. The questionnaire was made of four sections: socio-demographics characteristics included, knowledge of EFM, Practice of EFM and Challenges faced by Mid-wives. A total of fourteen questions were asked to determine their level of knowledge regarding EFM. A score of 1 was assigned for each correct response and 0 for incorrect response. An overall score of 7 (7.74 ± 1.65) and above was classified as Adequate knowledge, for practice regarding EFM 15 questions were asked. An overall score of 8 and above was classified as good practice. . Pre-testing was done among five mid-wives at the Kumba Regional Hospital to ensure validity and reliability. The questions were adjusted then, the questionnaire was administered using the English language to collect data

Data management and analysis

After data collection, the questionnaires were double-checked for consistency, missing values were replaced with the mean values. The data were entered into Microsoft Excel 2010 and imported to the Statistical Package for Social Sciences (SPSS version 26) for cleaning and analysis. Descriptive statistics was used to present frequencies and percentages. Logistic regression analysis was used to determine factors of adequate knowledge. Odds ratio (OR) estimates and confidence interval (95% CI) with p values <0.05 were considered statistically significant.

Ethical considerations

The ethical clearance was obtained from the Institutional Review Board of the Faculty of Health Sciences of the University of Buea (Ref N°:P42/MINSANTE/SWR/RDPH/RCB.PT) . Administrative approvals were obtained from the Regional Delegation of Public Health for the South-West Region (Ref N°: 2025/022/UB/NUS/HOD/FHS)), and the directors of the health institutions. Potential participants were told the aim and benefits of contributing to the study, and a written informed consent was signed by study participants. Participants were free to quit at any point in the study.

III. RESULT AND DISCUSSION

1. Sociodemographic characteristics of study participants

A total of 39 midwives were recruited for this study with a mean age of 28.59 years and standard deviation of 6.19. Of these, 17 (43.6%) of the participants were aged 26-30 years. Majority 38 (97.4%) were females and 27 (69.2%) had a Bachelor's degree in Midwifery. With regards to working experience, the majority of the participants had less than 5 years of experience 23 (58.9%). A greater proportion of participants were midwives at the RHB 24 (61.5%) (Table 1).

2. Knowledge of Midwives regarding EFM

Respondents were asked questions to evaluate their knowledge of EFM based on the information provided by the respondents, all participants 39 (100%) had the knowledge that EFM primarily assesses FHR and uterine contractions. They also knew that the primary purpose of EFM is to detect potential foetal distress. Meanwhile, only 12(30.8%) agreed that the most accurate method of FHR monitoring in labour is internal spiral electrode. A total of 14 (35.9%) of study participants concorded that the baseline FHR variability is considered normal: moderate oscillations at (5-25 bpm). 13 (33.3%) knew that significant FHR variability loss might indicate potential foetal compromise, while 92 (36.8%) knew that Sinusoidal FHR pattern suggests potential foetal anaemia (Table 2). Out of the 39 participants that were sampled 20(51%) had adequate knowledge regarding EFM (Figure 1)

Factors associated with knowledge of EFM

Mid-wives who had a certified training had five times odds to have adequate knowledge compared to those who had not received training (aOR: 5.25, 95% CI: 1.54-7.13, p = 0.012) (Table 3).

3. Practice of Midwives regarding EFM

Patient identification and tocodynamometer placement as well as explaining procedures and patient privacy were perfectly compliant 22(100%) in Practice Skills, but only 15(68.2%) in Practice Skills explained the procedure and ensured patient privacy. Interpretation abilities were also consistent with 22(100%) accuracy in the identification of the baseline fetal heart rate and contraction patterns and 21 (95.5%) accuracy in judgment of variability and decelerations. Considering Clinical Decision-Making, 21 (95.5%) identified an urgent situation but only 17 (77.3%) took the right intervention based on abnormal patterns, Documentation adherence was 19 (86.4%) (Table 4).

Out of the 22 participants that were sampled, the majority 17(78.6%) had good practice regarding EFM (Figure 2)

Challenges faced in EFM

The most reported challenge faced by midwives regarding EFM use was limited continuous learning opportunities followed by difficulties in the interpretation of tracings; 36 (92.3%) and 26 (66.7%) respectively. A greater proportion of participants had high patient workload (61.5%). The absence of training programs at the hospital for personnel operating the EFM was another challenge (Figure 3).

Table 1: Sociodemographic characteristics of study participants

Variables	Category	Frequency (n=39)	Percentage (%)
Age (years)	21-25	13	33.3
	26-30	17	43.6
	≥ 31	9	10.3
Sex	Female	38	97.4
	Male	1	2.6
Educational level	State registered midwife	7	18
	BSc in Midwifery	27	69.2
	MSc in Midwifery	5	12.8
Working experience (years)	≤ 5	23	58.9
	6-10.	11	28.2
	> 10	5	12.8
Hospital	Regional Hospital Buea	24	61.5
	Regional Hospital Limbe	15	38.5
Frequency of EFM in midwifery practice	Daily	11	28.2
	Weekly	5	12.8
	Monthly	4	10.3
	Rarely	19	48.7
Received Certified formal training	No	24	61.5
	Yes	15	38.5

Type of Training	Basic midwifery education program	4	26.7
	Hospital in-service training	10	66.7
	Professional conference workshops	1	6.6

Table 1: Knowledge of Midwives regarding EFM

Variables	Yes	Percentage (%)
EFM primarily assesses FHR and uterine contractions	39	100
The primary purpose of EFM is to detect potential foetal distress	39	100
Normal FHR range during labour is 110-160 bpm	29	74.4
Most accurate method of FHR monitoring in labour is internal spiral electrode	12	30.8
Correct placement: Specific positioning over foetal heart / uterine fundus	29	74.4
EFM tracing requires calibration whenever signal quality seems poor	18	46.2
Baseline FHR variability is considered normal: moderate oscillations (5-25 bpm)	14	35.9
Early Decelerations in FHR gradually decrease and increase with contractions	16	41
Significant FHR variability loss might indicate potential foetal compromise	18	46.2
Sinusoidal FHR pattern suggests potential foetal anemia	13	33.3
A reactive non-stress test is characterized by accelerations with foetal movement	15	38.5
Significant prolonged decelerations last more than 2 minutes	20	51.3
Biphasic contractions on EFM typically indicate potential uterine hyperstimulation	25	64.1
Persistent late decelerations when observed, require immediate intervention	15	38.5

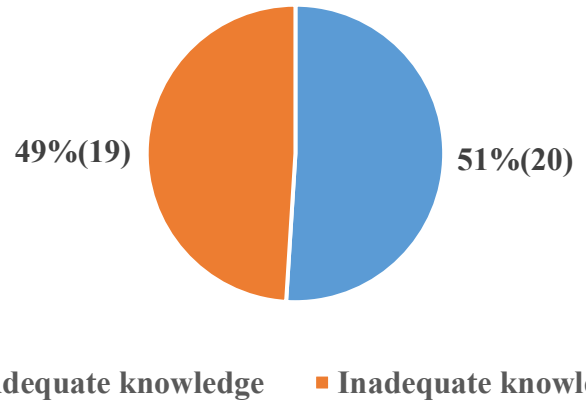


Figure 1. Overall Knowledge of Midwives regarding EFM

Table 3. Factors associated with knowledge of EFM

Variable	Category	cOR (95% CI)	p-value	aOR (95% CI)	p-value
Age (years)	≥ 31	3.20 (0.59 - 7.41)	0.178	2.22 (0.81 - 5.41)	0.098
	26 – 30	1.80 (0.45 - 5.20)	0.404	1.32 (0.65 - 3.45)	0.494
	21 – 25	1	-		
Educational level	MSc	4.33 (0.44 - 5.20)	0.188	3.36 (0.44 - 65.00)	0.081
	BSc	3.76 (0.48 - 8.12)	0.182	1.94 (0.49 - 5.12)	0.142
	SRM	1	-		
Work experience	> 10yrs	1.64 (0.23 - 4.76)	0.625	3.04 (0.23 - 4.76)	0.826
	6 – 10yrs	1.31 (0.31 - 5.53)	0.714	1.56 (0.31 - 5.53)	0.416
	≤ 5 yrs	1	-		
Received Certified Formal Training	Yes	4.00 (1.78 - 6.00)	0.007	5.25 (1.54 - 7.13)	0.012
	No	1	-	1	-

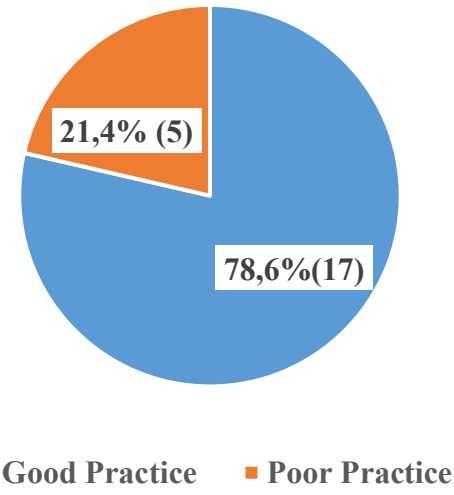


Figure 2. Midwives Practice regarding the use of EFM

Table 4: Practice of Midwives regarding EFM

Components of Practice assessment	Frequency (n=22)	Percentage (%)
Practice Skill		
Explains procedure to the woman before starting and ensures privacy	15	68.2
Confirms correct patient identity	22	100
Places tocodynamometer at the fundus where contractions are best palpated	22	100
Places ultrasound transducer over the area of maximum fetal heart sounds and secures transducers with belts at appropriate tension	16	72.7
Ensures woman's comfort during monitoring	20	90.9
Interpretation Skill		
Correctly identifies baseline FHR	22	100
Accurately assesses FHR variability	21	95.5
Identifies presence/absence of accelerations and types of decelerations	21	95.5
Identifies uterine contraction frequency and duration	22	100
Recognizes normal vs. abnormal patterns and identifies changes in the pattern over time	22	100
Clinical decision- making skill		
Implements appropriate interventions for abnormal patterns	17	77.3
Evaluates and documents effectiveness of interventions	22	100
Communicates findings clearly to healthcare team	22	100
Documents FHR findings according to protocol	19	86.4
Recognizes situations requiring urgent intervention	21	95.5

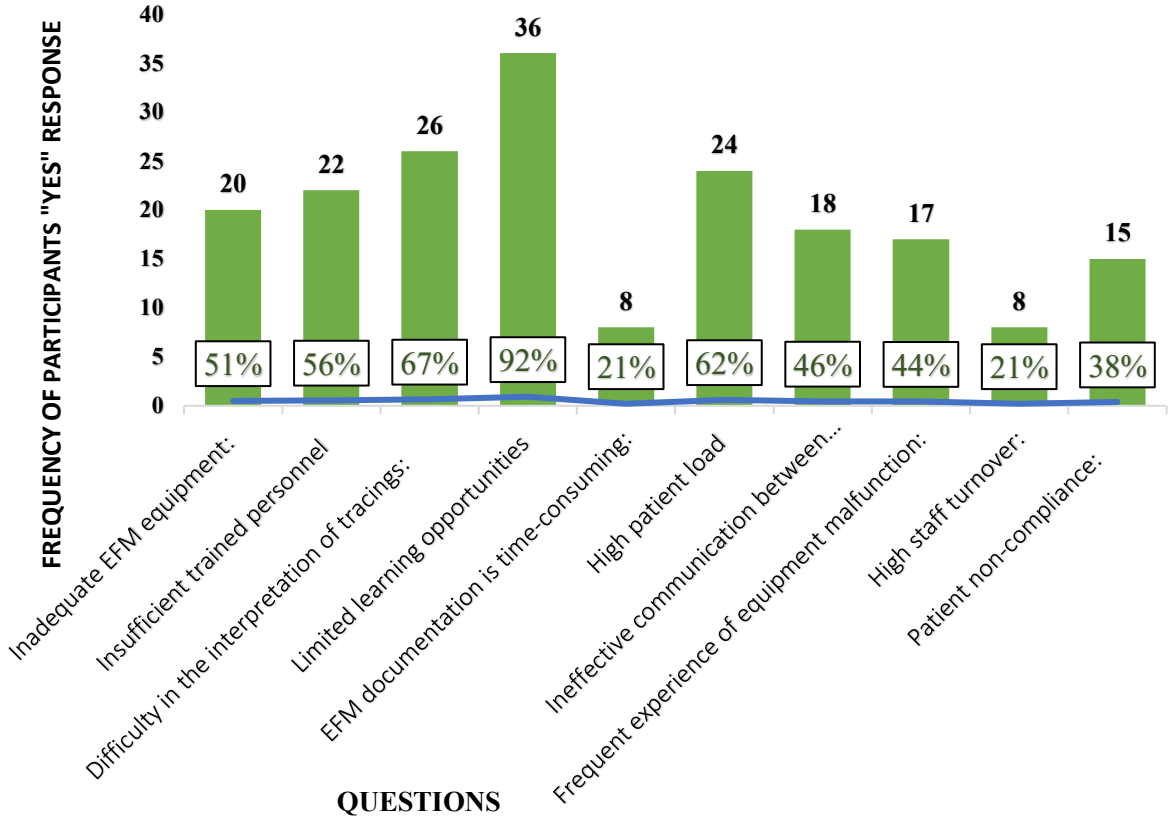


Figure 3. Challenges Faced in EFM

Findings from this study revealed that 20(51%) of the study participants had adequate knowledge regarding EFM while 17 out of the 22 sampled (78.6%) had good practice. The challenges reported according to this study were limited continuous learning opportunities and difficulty in the interpretation of tracings, having high patient workload and insufficient trained personnel to operate EFM effectively.

Knowledge of Electronic Foetal monitoring among Midwives

This study found that 51% of midwives demonstrated adequate knowledge of EFM, with a mean knowledge score of 7.74 ± 1.65 out of 14 possible points. This finding aligns closely with a study conducted in South Africa, which reported 65% accuracy in EFM interpretation following training interventions [8].The reason for the higher knowledge might be due to the difference in health care system, resources and training programs. Another study done in Jordan, reported knowledge scores of 68.7% among participating midwives [9]. The lower knowledge score in this study, compared to Jordan, likely reflect systemic differences in continuing education programs, resource allocation for professional development, and standardized training protocols. Only 30.8% of midwives correctly identified the most accurate method of fetal heart rate monitoring, and merely 35.9% demonstrated understanding of baseline FHR variability parameters. These findings mirror the South African experience where the study reported that clinical experience alone did not translate to improved knowledge levels, suggesting that systematic gaps exist in both basic and continuing education curricula [10]. Given our study's findings where 61.5% of participants had not received certified formal training in EFM, this gap explains why there is limited knowledge of EFM among midwives at the Buea and Limbe Regional Hospitals. Those who received certified formal training had higher odds of adequate knowledge than those who didn’t

Practice of Electronic Foetal Monitoring among Midwives

The observational component of this study revealed good practice with up to 78.6% of midwives demonstrating good EFM practice. This finding is in line with a study carried out in Ghana, which reported that 58.6% of midwives demonstrated competent EFM application [11]. Similar to this study, midwives demonstrated excellent performance in basic technical skills such as patient identification (100%) and transducer placement (100% for tocodynamometer, 72.7% for ultrasound transducer).These results also agreed with another study observed, where basic positioning skills were adequate [12]. A similar study carried out by daglar and colleagues also found a good practice (80.6%) of midwives on EFM. The reason for this slight difference with our study may be because they were evaluated after a training program[13]. Our study was also in line with other higher-resource setting, where systematic training programs were more readily available and consistently implemented [14].

Challenges faced by Midwives in Electronic Foetal Monitoring

The most frequently reported challenges were limited continuous learning opportunities (92.3%) and difficulty interpreting tracings (66.7%), followed by high patient workload (61.5%) and insufficient trained personnel (56.4%). These findings align closely with barriers identified in a similar qualitative study in Tanzania [15], which documented individual, institutional, and community-related barriers to effective fetal monitoring implementation. The prominence of educational and training-related challenges in the current study reflects patterns observed across multiple African healthcare systems. Studies in Nigeria and Uganda similarly identified staff shortages and skills gaps as primary barriers to effective labor monitoring [16]. However, the specific emphasis on continuous learning opportunities in this study suggests that midwives recognize their knowledge limitations and desire professional development support, which represents a positive foundation for intervention planning. The infrastructure-related challenges documented, including equipment availability and maintenance issues, mirror findings in another study done in South Africa, where a majority of midwives reported equipment-related barriers to optimal care delivery [17]. The Regional Hospital settings in this study provided better equipment access compared to primary facilities, but challenges with maintenance and technical support appear to be consistent across different levels of the healthcare system. The high patient workload identified as another significant challenge (61.5%) reflects broader human resource constraints affecting healthcare delivery in Cameroon and similar contexts.

IV. CONCLUSION

This study revealed that the knowledge of midwives regarding EFM is 20(51%). majority 17(78.6%) had good practice regarding EFM. The most frequently reported challenge regarding the use of EFM among study participants was limited continuous learning opportunities regarding EFM indicating a substantial knowledge gap that can affect obstetric care. Discrepancies in knowledge levels of EFM across studies underline the need for refresher EFM training programs, incorporating both theoretical knowledge and practical skills development tailored to context to ensure sustained competency in low-resource settings such as Cameroon. This is because in low-resource settings, the lack of resources has been found to be an obstacle to implementation of new knowledge. To mitigate the challenge of limited continuous learning opportunities faced by midwives, advanced education programs to strengthen their knowledge about the use of EFM. Guidelines should be pasted and clearly communicated in health facilities and updated regularly which could increase continues learning opportunities and enhance compliance.

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