

Study on the Impact of Obstetric Ultrasound Training Applied to Sonus in the Pété Health District, Saint-Louis Region, from 2021 to 2025

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Abstract

Introduction: Maternal mortality remains a major public health issue in Senegal, particularly in rural areas where access to specialised obstetric services remains limited. Obstetric ultrasound, as a tool for early diagnosis, is an essential lever for improving the quality of prenatal care and monitoring high-risk pregnancies. It is in this context that the Faculty of Health Sciences at Gaston Berger University (UFR2S), in partnership with the Regional Hospital of Saint-Louis (HRSL), has initiated a training programme in obstetric ultrasound applied to Emergency Obstetric and Neonatal Care (EmONC) for midwives in the Pété health district. The aim of this study was to evaluate the impact of this training on the quality of obstetric care and the clinical performance of providers. **Methodology:** This is a descriptive, analytical, cross-sectional study conducted in September 2025 among all 18 midwives trained between 2021 and 2025. Data were collected using a structured questionnaire and analysed using Epi Info 7 software. **Results:** show a significant increase in the average number of monthly ultrasounds, from 12 before to 33 after training (+175%). The proportion of complications detected early rose from an average of 1% to 5.6%, representing a gain of 4.6 points. The relevance of obstetric referrals also increased from 62% to 87%, while 92.9% of midwives reported being satisfied or very satisfied with the programme. **Conclusion:** Training in obstetric ultrasound applied to SONUs has led to a lasting improvement in skills, better detection of complications and a rationalisation of evacuations. This decentralised, partnership-based model represents a good practice that can be replicated in other districts of Senegal and contributes to the achievement of national targets for reducing maternal and neonatal mortality.

Keywords

Obstetric Ultrasound, SONU, Midwives, Training, Pété, Maternal Health, Senegal

1. Introduction

Maternal and neonatal mortality are major global public health issues. In 2023, approximately 260,000 maternal deaths were recorded, equivalent to one woman every two minutes [1]. More than 95% of these deaths occur in low- and middle-income countries, particularly in sub-Saharan Africa [2]. In Senegal, although progress has been made since 2000, the maternal mortality rate is still estimated at 236 deaths per 100,000 live births in 2020, with significant disparities between urban and rural areas [3]. Direct obstetric causes account for approximately 60% of maternal deaths [4]. To reduce this burden, the national strategy focuses on the continuous availability of Emergency Obstetric and Neonatal Care (EmONC) and the strengthening of staff skills [5]. Obstetric ultrasound is an essential tool for the early detection of high-risk pregnancies and improved care [6] [7]. In this context, the UFR2S of Gaston Berger University, in partnership with the Regional Hospital of Saint-Louis, has been offering training in obstetric ultrasound applied to EmONC for midwives in the Pété health district since 2021. Between 2021 and 2025, eighteen midwives have been trained free of charge, in cohorts of three, for three-month practical internships. This initiative illustrates the social responsibility of the UFR2S and its desire to bring ultrasound to rural communities. The Pété district covers a vast rural area with major geographical and logistical constraints. The dispersion of villages, the distance of health posts from the health centre and the lack of transport contribute to the three classic delays in maternal mortality: delay in deciding to seek care, delay in accessing services and delay in receiving appropriate care [8]-[11]. The training of midwives in obstetric ultrasound aims to delegate skills and bring diagnosis closer to communities. However, there is still no local scientific data to measure its real impact. It is therefore essential to document this intervention in order to support its expansion and sustainability. The general objective was to evaluate the impact of obstetric ultrasound training applied to EmONC on the quality of obstetric care in the Pété district. The specific objectives were to describe the process and characteristics of obstetric ultrasound training applied to EmONC carried out from 2021 to 2025 for midwives practising in the Pété health district, to present the profile of the actors involved in the implementation of the programme, specifying their roles and responsibilities at the Pété district level, from 2021 to 2025, to measure the changes observed in the professional practices of trained midwives in the Pété district, before and after the training at the Pété district level, from 2021 to 2025, and to assess the overall satisfaction of trained midwives at the Pété district level, from 2021 to 2025.

2. Methodology

This is a descriptive, analytical, cross-sectional study conducted among all midwives who have received training in obstetric ultrasound applied to EmONC. This design was chosen to document the knowledge acquired, perceptions, changes in practices and effects felt after the training. The study was conducted in the Pété health district, Saint-Louis medical region, Senegal. The district covers an estimated rural population of more than 120,000 inhabitants spread across 10 health posts and 25 health huts. It is characterised by:

- long distances between villages and health facilities;
- mobility constraints (tracks, seasonal flooding);
- a lack of logistical resources and imaging equipment;
- a high degree of community dependence on health posts for obstetric care.

Since 2021, as part of the partnership between the UFR2S of Gaston Berger University (UGB) and the Regional Hospital of Saint-Louis (HRSL), an innovative initiative has enabled the training of 14 midwives from the district in obstetric ultrasound applied to EmONC. These training courses were carried out in successive cohorts of three providers, with theoretical and practical supervision over three months. Data collection took place from 15 to 30 September 2025 at health posts and the health centre in the district of Pété. The target population included all midwives trained in obstetric ultrasound applied to EmONC in the Pété health district. The inclusion criteria were to have completed the training organised by UFR2S and HRSL; to be working in the Pété health district at the time of the survey; and to have given free and informed consent to participate in the study. We did not include midwives who had been trained but transferred to other districts; those who were absent or unavailable during the data collection period; or those who refused to participate in the survey.

The study included all trained midwives, using an exhaustive approach (complete census), justified by the limited number of training beneficiaries and the importance of having a comprehensive view of the impact in the district.

The independent variables were the sociodemographic profile: age, seniority, assignment structure, length of practice, level of initial training; training modalities: year, duration, modules taken, practical setting, support from trainers, and availability of ultrasound equipment at the health centre. The dependent variables d **professional practices** (number of ultrasounds performed per month, types of indications (antenatal care, emergencies, complications), types of pathologies detected); **the perceived effect of the training** (improved diagnoses, relevance of obstetric referrals, speed of decision-making, reduction in unjustified evacuations); **satisfaction and appropriation**: satisfaction with the content, teaching methods, duration and conditions of the training course; feeling of confidence and autonomy in ultrasound practice; **constraints encountered**: insufficient equipment, lack of maintenance, difficulties in interpretation, insufficient supervision.

Data collection was carried out using a structured, self-administered questionnaire designed in Google Forms and pre-tested on two midwives who were not

included in the study. The questionnaire comprised five sections: general information and provider profile; training methods and assessment; ultrasound practices before and after training; perception of the effects of training on quality of care; difficulties encountered and suggestions for improving the programme. The midwives completed the questionnaire via telephone or tablet. The data was exported to Excel for validation and cleaning prior to analysis. The data was entered into Excel and then analysed using Epi Info 7. A double check was carried out to ensure consistency and completeness. **The descriptive analysis** focused on frequencies, percentages, means and standard deviations for quantitative and qualitative variables. **Comparative analysis:** comparison of indicators before/after training (average number of ultrasounds, complications detected, obstetric referrals) using McNemar or Wilcoxon tests depending on the nature of the variables. **Thematic analysis:** for open-ended questions, responses were grouped into themes (perception, motivation, constraints, suggestions). The statistical significance threshold was set at $p < 0.05$ with a 95% confidence interval (95% CI).

Free and informed consent was obtained from each participant after explaining the objectives, benefits and minimal risks of the study. Anonymity and confidentiality were guaranteed: no names or specific structures were mentioned in the database. The results will be presented to midwives, the Pété health district and partners (UFR2S, HRSL) in line with social responsibility and continuous improvement of professional skills.

3. Results

3.1. Describe the Course of Training in Obstetric Ultrasound Applied to EmONC

Training location: The majority of the midwives trained benefited from their internship at the Saint-Louis Regional Hospital, a university partner of UFR2S. This result confirms that the university-hospital partnership is the main platform for strengthening practical skills, guaranteeing the quality of learning and clinical supervision (**Table 1**).

Table 1. Distribution of midwives according to the duration of training. (in months)

Modality	Number	Percentage (%)
2 months	3	21.4
3 months	9	64.3
4 months	2	14.3
Total	14	100

The results indicate that **nearly two-thirds (64%)** of midwives underwent three months of training, which is considered sufficient for acquiring basic skills in obstetric ultrasound. A few participants (21.4%) underwent shorter training periods, often due to professional or logistical constraints, while others benefited from extended reinforcement training.

Analysis of the training programme reveals:

- ✓ a concentration of sessions in reference structures (HRSL and UFR2S);
- ✓ an average duration in line with the academic benchmark of three months;
- ✓ a coherent and supervised organisation, combining theory and practice;
- ✓ strong involvement of institutional partners (UFR2S, HRSL, Pété health district).

These results demonstrate that the training programme is structured, adapted to the rural context and fully compliant with national standards for continuing education in SONU.

3.2. Profile of Trainers and Midwives Trained in Obstetric Ultrasound Applied to EmONC

The distribution shows a representation of district structures more at the level of health posts, reflecting the programme's inclusive strategy aimed at strengthening the capacities of midwives at the peripheral level. This decentralised approach promotes wider coverage of ultrasound skills in the field (**Table 2**).

Table 2. Distribution of midwives according to the facility to which they are assigned.

Health facility	Number	Percentage
Health centre	2	14.3
Health Post	11	78.6
Other district	1	7.1
Total	14	100

Nearly 65% of midwives have less than 4 years' seniority in their current position. This reflects recent staff turnover and a strategy of rapidly developing the skills of young practitioners. More experienced midwives (≥ 6 years) account for around one-fifth of the total, playing a key role in supervising new graduates and passing on best practices (**Table 3**).

Table 3. Distribution of midwives according to their length of service in their current organisation.

Seniority	Number	Percentage (%)
Less than one year	2	14.3
1 to 3 years	6	42.8
4 to 6 years	3	21.4
Over 6 years	3	21.4
Total	14	100

The predominance of state midwives (71%) shows that training is primarily targeted at permanent staff, ensuring the sustainability of investment in skills.

However, the participation of a few contract workers and volunteers reflects a desire for openness and overall strengthening of obstetric capacities throughout the district (**Table 4**).

Table 4. Distribution of midwives by socio-professional category.

Category	Number	Percentage
State midwife	10	71.4
Contract midwife	3	21.4
Midwifery student/volunteer	1	7.2
Total	14	100

The programme is based on a solid tripartite partnership between the university, the referral hospital and the district. This configuration ensures consistency between the needs on the ground and the training offered, while guaranteeing the academic quality and technical supervision of the programme.

Analysis of the profiles of trainers and beneficiaries highlights:

- ✓ a balanced representation of district health structures;
- ✓ a high proportion of state midwives, ensuring the sustainability of the programme;
- ✓ direct involvement of UFR2S and HRSL in the design and implementation;
- ✓ a solid institutional foundation promoting local ownership and the sustainability of the programme.

These elements confirm that the Pété district training programme has been inclusive, well-targeted and institutionally supported, in line with the regional vision of strengthening EmONC (**Table 5**).

Table 5. Partner institutions and supervisors of the training programme.

Institution/Partner	Role in training	Observations
UFR2S – Gaston Berger University	Programme design, academic supervision	Scientific coordination of the SONU curriculum
Saint-Louis Regional Hospital	Practical supervision, clinical training	Supervision of practical sessions and post-training follow-up
Pété Health District	Selection of beneficiaries, local supervision	Logistical support and follow-up of trained providers
Saint-Louis Health District	Institutional validation and integration into the regional plan	Facilitates recognition of training

3.3. Measuring Changes Observed in Professional Practices after Training

After training, the average number of ultrasounds performed by midwives more than doubled, reflecting greater technical autonomy and increased patient access to local obstetric imaging. This progress demonstrates the immediate and measurable impact of training on service provision at the peripheral level (**Table 6**).

Table 6. Comparison of the number of ultrasounds performed by midwives before and after training.

Period	Monthly average	Standard deviation	Relative change
Before training	12	± 5	–
After training	33	± 9	+ 175%
Average difference (Δ)			+ 21 ultrasounds/month

Detection rates increased for all major complications, including intrauterine foetal death and HRP, thanks to midwives' ability to recognise early ultrasound signs. This improvement reflects a direct impact on the quality of obstetric care and a reduction in the decision-making time for emergency evacuations (**Table 7**).

Table 7. Average proportion of complications detected before and after training.

Type of complication	Before (%)	After (%)	Absolute gain
HRP (retroplacental haematoma)	1	7	+ 6
Ectopic pregnancy	0	3	+ 3
Foetal death in utero	2	8	+ 6
Placenta praevia	0	4	+ 4
Incomplete abortion	1	6	+ 5
Overall average	1	5.6	+ 4.6 points

3.4. Relevance of Obstetric Referrals

The training enabled midwives to better select cases requiring referral, significantly reducing inappropriate evacuations. This rationalisation helps to relieve pressure on referral facilities and optimise emergency resources in the district. The before/after comparative assessment highlights:

- a substantial increase in the number of ultrasounds performed,
- improved detection of major obstetric complications,
- a clear improvement in the relevance of referrals,
- an overall strengthening of the diagnostic and decision-making capacities of trained midwives.

These results confirm that training in obstetric ultrasound applied to EmONC has had a tangible effect on clinical performance and the quality of maternal care in the Pété health district (**Table 8**).

Table 8. Relevance of obstetric referrals before and after training.

Period	Justified referrals (%)	Unjustified referrals (%)	Relevance ratio
Before training	62	38	1.63
After training	87	13	6.69
Change	+ 25 points	– 25 pts	× 4.1

3.5. Assessing the Satisfaction of Trained Midwives with Obstetric Ultrasound Training Applied to Emergency and Critical Care

Over 90% of trained midwives say they are satisfied or very satisfied with the training they received. This high level of satisfaction reflects the relevance of the content, the quality of the supervision, and the perceived value of the skills acquired for daily practice (Table 9).

Table 9. Overall level of satisfaction among trained midwives.

Level of satisfaction	Number	Percentage
Very satisfied	9	64.3
Satisfied	4	28.6
Somewhat satisfied	1	7.1
Not satisfied	0	0
Total	14	100

The highest-rated aspects were supervision by trainers (79% very satisfied) and educational content (71%). Areas for improvement include post-training follow-up, which some beneficiaries considered insufficient, and equipment, which was sometimes limited in certain peripheral structures. These observations highlight the need to strengthen the mentoring and equipment maintenance systems (Table 10).

Table 10. Satisfaction according to training components.

Component evaluated	Very satisfied (%)	Satisfied (%)	Somewhat satisfied (%)
Programme content	71	29	0
Duration of training	64	29	7
Materials and equipment	57	36	7
Supervision of trainers	79	21	0
Post-training follow-up	43	43	14

Midwives perceive training as a major lever for professional empowerment. They report greater recognition of their role in obstetric care and a concrete impact on reducing inappropriate evacuations. Ultrasound skills thus appear to be a key factor in professional empowerment and improving the quality of emergency obstetric care. The satisfaction survey reveals that (Table 11):

- The training is highly appreciated by the beneficiaries (more than 90% satisfied),
- The trainers and teaching methods were very positively evaluated,
- Improvements are expected in terms of post-training follow-up and equipment maintenance,

- The training had a positive psychosocial impact on the motivation and confidence of the providers.

Table 11. Midwives' perceptions of the usefulness of the training.

Perception expressed	Number	Percentage
Strengthened my professional confidence	13	92.9
Improved the quality of my care	12	85.7
Contributed to reducing unnecessary evacuations	10	71.4
Led to greater recognition by patients	11	78.6

4. Discussion

The results of this study confirm that training in obstetric ultrasound applied to SONUs had a significant impact on the skills, quality of care and clinical performance of midwives in the Pété health district. This improvement reflects the relevance of a decentralised and practical training approach, already documented in several African contexts [6]-[12]. The increase in the average number of monthly ultrasounds after training demonstrates the midwives' increased technical proficiency and decision-making autonomy. Studies conducted in Ethiopia, Tanzania and Malawi have shown that targeted training in basic ultrasound for mid-level providers improves the detection of high-risk pregnancies and the quality of obstetric triage [7]-[13].

These results are consistent with WHO recommendations, which encourage the integration of ultrasound into antenatal care to strengthen maternal and foetal monitoring [14]. Thus, in the Senegalese context, this initiative helps to reduce dependence on regional hospitals and promotes rapid decision-making at the peripheral level. The study shows a notable increase in complications detected early after training (HRP, ectopic pregnancy, placenta praevia, intrauterine foetal death). This improvement is in line with Thaddeus and Maine's three delays model, according to which early detection is one of the major determinants of maternal survival [11]. Similar programmes implemented in Kenya and Zambia have shown that the introduction of point-of-care ultrasound by midwives significantly reduces severe maternal morbidity [15] [16]. Training therefore enhances clinical safety while improving patients' confidence in primary care facilities.

The increase in the relevance of obstetric referrals (from 62% to 87%) shows that trained midwives now refer cases according to objective criteria based on ultrasound examination. Studies in Nigeria and Ghana have shown that such rationalisation reduces unjustified transfers by up to 40% [10]-[17]. This development optimises the management of obstetric emergencies and allows for better use of hospital resources.

Over 90% of midwives surveyed reported being satisfied or very satisfied. This result reflects the perceived value of the training and its relevance to daily practice.

As reported by Mwansa *et al.* in Zambia, post-training satisfaction is a determining factor in staff motivation and retention [18]. The direct involvement of

UFR2S and HRSL strengthened institutional confidence and promoted local ownership of the programme.

Pété's experience illustrates an effective partnership model between the university, the health district and the referral hospital. This system is in line with the guidelines of the 2019-2028 National Health and Social Development Plan and aligns with Sustainable Development Goal 3.1, which aims to reduce the maternal mortality ratio to below 70 per 100,000 live births by 2030 [14]-[19]. Its regional extension would strengthen universal health coverage for maternal health in Senegal.

Limitations of the study are the small sample size (14 midwives), limiting the generalisability of the results, the comparative before/after data based on declarative memory, and the absence of direct measurement on patients. However, these limitations do not affect the internal validity of the descriptive and interpretative results.

5. Conclusion

The aim of this study, conducted in the Pété health district between 2021 and 2025, was to assess the impact of obstetric ultrasound training applied to EmONC on midwives' skills, the quality of obstetric care and the performance of the local health system.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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