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The effectiveness of simulation-based training in preparing healthcare providers as childbirth simulation facilitators

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Abstract

Background

Improving the quality of maternity care is critical to reduce preventable maternal and newborn mortality and morbidity. Simulation-based learning strengthens clinical competence and confidence, yet sustainable implementation in low-resource settings depends on locally trained facilitators. In the Democratic Republic of the Congo (DRC), persistent gaps in quality of care contribute to poor health outcomes. This study aimed to determine the effectiveness of simulation-based training in preparing healthcare providers to function as facilitators in childbirth simulation.

Methods

A mixed-methods explanatory sequential design was employed. Twelve healthcare providers (six midwife students and six medical doctors) from five clinical sites in Eastern DRC participated in a four-day training programme covering the courses Essential Care for Labor and Birth, Vacuum-Assisted Birth (VAB), and Bleeding after Birth Complete (BABC). To assess the statistical significance of the change in knowledge, quantitative data was collected through pre- and post- knowledge tests for each course, and Objective Structured Clinical Examinations (OSCE). Qualitative data were collected through two focus group interviews (n = 11) and analyzed using deductive content analysis guided by Moore's process evaluation framework. Effectiveness was evaluated across four domains: fidelity, dose/exposure, reach, and acceptability.

Results

The simulation-based training was delivered with high fidelity, adhering to the intended schedule and pedagogical structure. Regarding dose/exposure, all participants passed the OSCEs, demonstrating achievement of competency targets. Significant knowledge gains were observed in courses introducing new clinical skills, including VAB ($p = 0.021$) and BABC ($p = 0.027$). Reach was reflected by participant engagement and a successful interprofessional mix of midwives and physicians, with role-rotation strengthening their confidence to function as facilitators. The training demonstrated acceptability, being perceived as innovative and relevant to the context, although participants identified structural barriers—such as staff shortages and limited resources—as challenges to the sustainability and long-term feasibility of the intervention.

Conclusions

Structured simulation-based training can effectively prepare healthcare providers for facilitator roles in childbirth simulation, enhancing both clinical competence and pedagogical confidence. Integrating

facilitator preparation into existing educational structures represents a feasible strategy for sustainable capacity building in low-resource settings. Continued institutional support is essential to sustain implementation in clinical practice.

Trial Registration:

The study is registered with ISRCTN number: 10049855.

Background

Ensuring safe, high-quality care during pregnancy and childbirth is essential for women's health and well-being. Complications during pregnancy and childbirth remain among the leading causes of morbidity and mortality for women of reproductive age worldwide (1). In low-resource settings such as the Democratic Republic of Congo (DRC), the challenges in providing high-quality maternal healthcare contribute to the country's high maternal mortality ratio (2). Although an estimated 80% of births occur in health facilities, maternal and neonatal morbidity and mortality remain unacceptably high (3), indicating deficiencies in the quality of care during childbirth. This is closely linked to healthcare providers' access to evidence-based knowledge, skills and supportive learning environments.

Investing in midwives educated according to international standards is essential to improve maternal and newborn health outcomes (4). Midwives largely use a salutogenic focus on childbirth, meaning that care is oriented toward promoting health and women's inherent capacity for physiological birth rather than concentrating on complications (5). A pressing concern within childbirth care is that physiological, spontaneous vaginal birth is increasingly being replaced by caesarean section, a global trend that includes the DRC and widely exceeds the World Health Organisation's recommendations. Therefore, healthcare professionals need increased competence in promoting physiological, spontaneous vaginal birth as the primary mode of birth and, when necessary, in performing instrumental birth using vacuum extraction (6). Many care-related errors are preventable through improved adherence to evidence-based practice and strengthened clinical training (7, 8)

Simulation-based learning has been identified as an important pedagogical approach within health professions education (9–11), offering learners opportunities to engage in realistic clinical scenarios that enhance practical skills, decision making, communication, and ultimately patient safety (12). Using simulation as a pedagogical tool is grounded in complementary learning theories, including behavioral, constructivist, and social cognitive theories, that together explain how learners acquire and retain competence through deliberate practice, reflections, and the development of self-efficacy in realistic clinical scenarios. These theoretical foundations underscore the value of active learning approaches that support skill acquisition, reflection and professional development, reinforcing the central role of simulation-based learning in competency-based health professional education (13).

Implementing complex interventions like simulation-based learning requires robust strategies. Facilitation has been identified as such strategy and has been proven to support implementation of new clinical practices or working models (14) by streamlining change processes and aligning innovations with existing practices (15). Facilitation is described within the integrated Promoting Action on Research Implementation in Health Services (i-PARIHS) framework, as a core skill for successful implementation that brings together three key elements: the innovation being implemented, the recipients who will adopt or be affected by it, and the context in which implementation occurs (16). This calls for a facilitator - an individual appointed the role - in supporting implementation. In such role, it is common to choose staff from the care context where the innovation is being implemented, as their contextual knowledge enables them to identify practical solutions and promote a culture of collaboration and teamwork (17). However, they must be adequately prepared for this role and equipped with knowledge and skills to navigate challenges and ensure effective implementation (18, 19).

Using simulation-based learning in promoting evidence based care during childbirth has demonstrated improvements in clinical routines, reductions in emergency caesarean section rates, and increased spontaneous vaginal births without negative outcomes (20, 21). This suggests that using adequately equipped facilitators to strengthen simulation-based learning has the potential for improving maternal health outcomes. Accordingly, the aim of this study is to determine the effectiveness of simulation-based training for healthcare providers to function as facilitators in childbirth simulation.

Methods

Research design

A mixed-methods explanatory sequential design including quantitative and qualitative data and analysis was used (22). Using mixed methods allows for triangulation, thereby strengthening the validity of the results (20). In accordance with Moore's process evaluation framework (21), effectiveness was operationalised as implementation effectiveness, namely the quantity and quality of what was delivered and received, and the extent to which findings may be generalisable when accounting for context. We therefore assessed effectiveness across four domains: fidelity (adherence to intended training content and adaptations), dose/exposure (amount of training delivered and changes as a result), reach (participant engagement), and acceptability (perceived relevance usefullness and needed improvements) (21), ultimately leading to evidence-based conclusions and recommendations.

Data collection and analysis were conducted in three phases, inspired by a methodology described by Creswell et.al (22). In the first phase, quantitative data were collected and analysed. The result from this first phase then informed the subsequent qualitative phase of data collection and analysis. Finally in the third phase the results from phase one and two were integrated (22), using a process evaluation framework (21) as a structured way to support the understanding, not only if the intervention was effective but also how, why, and under what conditions.

The study is reported according to the Template for Intervention Description and Replication (TIDieR) (23) and to the consolidated criteria for reporting qualitative research (COREQ) (24). The National Ethical of Public Health; CNES 001/DPSK/201PP/2022, Bukavu DRC approved the study.

Setting

In the DRC, efforts towards strengthening midwifery education have progressed over the past decade and is delivered as a 3 year direct-entry program and an 18- month post-graduate midwifery programme (90 credits) at a bachelor level. This study focusses on the 90 credits post-graduate bachelor's degree midwifery programme for nurses with a 3-year education offered by the Faculty of Medicine and Community Health at the Evangelical University in Africa (UEA) and its clinical practice sites in eastern DRC. Furthermore, following the national curriculum, the programme includes two additional profiles, one of which focuses on simulation-based learning aiming at accelerating the integration of theoretical learning, simulation, and clinical practice. The clinical practice courses for the midwife education programme were at the time of the study delivered at five affiliated hospitals, located in the South and North Kivu provinces in Eastern DRC, four in the South province and one in the North province.

Intervention: Simulation-based training

The intervention comprised a training programme designed to strengthen the capacity of healthcare providers to implement childbirth simulation within clinical practice settings. A total of 12 healthcare providers were trained in three simulation-based courses: (i) Essential Care for Labour and Birth (ECLB), including support for normal physiological vaginal birth ; (ii) Vacuum-Assisted Birth (VAB), focusing on the safe and evidence-based use of vacuum extraction (25) and (iii) Bleeding After Birth Complete (BABC), comprising two courses on the prevention and management of postpartum haemorrhage (26).

The training was conducted over four days, with one day dedicated to ECLB, one day to VAB, and two days to BABC. Each course combined structured didactic sessions with hands-on simulation-based training. To strengthen participants' confidence and facilitation skills, all sessions were co-facilitated by participants alongside experienced external facilitators (FT and MBe), who are members of the research team. Following completion of the training, each of the five sites received equipment, including course materials for all three trainings (flipcharts, posters, and facilitator guidebooks), Laerdal simulation equipment (MamaBirthie, (27), NeoNatalie, and MamaNatalie Complete(28), a Medela vacuum extractor(29), as well as a cupboard for equipment storage and a table designated for training activities.

Participants

The 12 included participants comprised six student midwives currently employed as nurses while completing a post-graduate bachelor's degree midwifery programme and six medical doctors responsible for maternity care across five clinical practice sites linked to the midwifery education programme—four located in South Kivu Province and one in North Kivu Province. Participants were recruited through a collaborative process involving the director of the midwifery education programme

and the medical directors of the respective hospitals serving as clinical practice sites. Each hospital was represented by the maternity unit lead and either a gynaecologist or a physician with equivalent clinical responsibility. Before the interviews, the invited participants were given verbal and written information about the study. They were informed that participation was voluntary and that they had the right to withdraw at any time without explanation. All participants signed a consent form. At the time the focus group interviews were conducted, 11 of these 12 healthcare providers participated.

Data collection and analysis

Both quantitative and qualitative data were collected during and directly after the training intervention through pre- and post-tests, Standardised Objective Structured Clinical Exams (OSCE) and focus group interviews.

Quantitative Data collection- Pre- and post-test and Standardised Objective Structured Clinical Exams (OSCE)

The quantitative data was collected from each participant using the Jhpiego's standardised pre- and post-tests collected for each course. These written tests consisted of 20–24 multiple-choice knowledge questions covering the content of each of the courses.

OSCEs are widely used to assess practical skills, clinical reasoning, and adherence to evidence-based protocols in a controlled and reproducible manner, making them particularly suitable for evaluating the outcomes of simulation-based and competency-based training programmes (30). The OSCEs aims to evaluate each participants skills, knowledge and competence in topics taught in each course such as abdominal exam, vaginal exams, retained placenta, atony, repair of cervical tear etc. Performance is assessed using standardised checklists or rating scales to ensure objectivity, reliability, and consistency across candidates and examiners. Each OSCE requires 20–30 minutes to complete. The threshold for being considered competent at the end of the training session was if the participants performed 80% of the steps in the OSCE. Standardised OSCEs was used to practically assess each participants´ skills directly after each completed course.

Quantitative data analysis

Descriptive statistic from four pre- and post-tests and OSCE test results were calculated in SPSS. To assess the statistical significance of the change in participant knowledge, the non-parametric Wilcoxon signed-rank test was applied. This test was selected due to the small sample size (n = 12) and the ordinal nature of the test scores. The OSCE performance was also analysed at individual level. The significance level was set at 0.05. We chose not to adjust for multiplicity.

Qualitative data collection - Focus Group Interviews

After completion of the full training programme, two Focus Group Interviews (FGI) with a total of 11 participants were conducted. The characteristics of the study participants were as follows: Five participants were Medical Doctors of which four were male and one female. The remaining six participants were female Midwives. One Midwife and one Medical Doctor were from the North Kivu Region and then remaining participants were from the South Kivu Region. An additional female Medical Doctor was trained but unable to participate in the Focus Group Interviews.

The FGI´s were led by MBe in French and continuously translated into Swedish to FT who made field notes and asked follow-up questions. The FGI's were audio recorded and lasted 45–60 minutes. Basis for the interviews was a semi-structured interview guide, developed by the research group, covering the following components of the process evaluation framework: fidelity, dose/exposure, reach, acceptability (21). See Table 1 for research questions and data collection methods in relation to key concepts in the implementation framework.

Table 1
Research questions in relation to key concept in the implementation framework

Implementation framework	Research questions	Data collection method
Fidelity	Was the training programme delivered as intended? Were any adaptations or alterations made to achieve better contextual fit? If yes, what were they and when were they made?	FGI
Dose/Exposure	To what extent was the training programme achieved? To what extent has the training programme resulted in change? Why?	FGI, Pre- Post test, OSCE
Reach	To what extent were the participants engaged in the training programme? How could the participants engagement have been improved?	FGI
Acceptability	Was the training programme acceptable and perceived as relevant? Was the training program useful, and what challenges were encountered? How could the training program have been improved?	FGI

Qualitative data analysis

The transcripts from the FGI's were analysed using deductive qualitative (31) content analysis, guided by the process evaluation framework (fidelity, dose, adaptation, reach, and acceptability) (21). The transcripts were read multiple times to identify meaning units corresponding to the process evaluation framework. The meaning units were mapped under fidelity, dose, reach, acceptability, and adaptation.

Integration of quantitative and qualitative data analysis

Finally, the quantitative and qualitative results were integrated under fidelity, dose, adaptation, reach and acceptability to determine the effectiveness of simulation-based learning for health providers to function as facilitators.

Results

The findings demonstrate improvements in participants' knowledge and skills after the training, with statistically significant gains observed in courses introducing content that was new to participants. All participants achieved a 100% pass rate in the OSCE- tests. The qualitative findings further describe participants' experiences of the training in relation to fidelity, dose/exposure, reach, and acceptability, providing insight into how the intervention was delivered, received, and perceived within the educational and clinical context.

Fidelity

The training was delivered according to schedule, and some participants thought the time allocation was appropriate, while others expressed that the high volume of content within the scheduled timeframe was tiring. The participants stated that they had acquired new knowledge and skills specifically relevant to supporting vaginal births, including increased competence specifically in vacuum-assisted birth. Overall, the training was perceived as highly valuable and was described as exceeding participants' expectations.

The educational materials were described as well structured, with the combination of theoretical elements and practical, hands-on training using mannequins perceived as particularly effective. The use of complementary videos and materials such as flipcharts and posters, was explained to enhance understanding and knowledge retention.

Receiving both theoretical instruction and simulation increased our knowledge and promoted learning. Practicing hands-on allowed us to self-assess our skills. (FGI 1)

Dose/Exposure

The quantitative results demonstrated that all participants successfully passed the OSCE, indicating that the predefined training milestones and competency targets were achieved. The mean scores for each pre- and post-test are presented in Table 2. An increase in mean scores was observed across all courses

following the training. Statistically significant improvements were observed for the Vacuum Assisted Birth course (p = 0.021) and Bleeding After Birth Complete 2.0 – Day 2 (p = 0.027). No statistically significant differences were found for Essential Care for Labor and Birth (p = 0.137) or Bleeding After Birth Complete 2.0 – Day 1 (p = 0.301). We chose not to adjust for multiplicity.

Courses that introduced clinical knowledge and skills largely new to participants, showed statistically significant improvements. Most participants reported limited prior exposure to Vacuum Assisted Birth, which may explain the observed increase in knowledge scores. Similarly, Day 2 of the Bleeding After Birth Complete course focused on advanced PPH management interventions, including uterine balloon tamponade and the use of the Non-pneumatic Anti-Shock Garment (NASG), which were unfamiliar to many participants.

In contrast, Essential Care for Labor and Birth and Day 1 of the Bleeding After Birth Complete course covered core content that participants were already familiar with, potentially limiting the magnitude of observable change in test scores.

Table 2
The findings from pre- and post-tests, Wilcoxon Sign Rank test p-value and OSCE pass-rates.

Course	**Pre-test mean score in %**	**Post-test mean score in %**	**Wilcoxon sign rank test** **p-value (< 0.05)**	**OSCE pass-rate**
Essential Care for Labor and Birth	89%	96%	0.137	100%
Vacuum Assisted Birth	47%	54%	**0.021**	100%
Bleeding After Birth Complete 2.0 Day 1	89%	92%	0.301	100%
Bleeding After Birth Complete 2.0 Day 2	68%	81%	**0.027**	100%

Significant results (< 0.05) are bold.

Participants expressed that the practical components of the training, particularly simulation scenarios, helped them to identify areas where improvements could be made, even in clinical practices where they perceived themselves as knowledgeable. The simulation scenarios facilitated critical reflection on routine practices and created opportunities for change. The participants also described that the principles of person-centred care were practiced in the training through simulation exercises as they experienced increased awareness of patient engagement, communication, and partnership during simulated scenarios. The training helped the participants to recognise and challenge outdated routines, leading to the participants explaining intentions to modify practices aligned with evidence-based care.

I thought I already knew how to do these things, but through practical training I realised that I do not know everything and have corrected what I was doing incorrectly. (FGI 1)

Reach

Participants described a high level of engagement throughout the training. Their involvement was influenced by the training's value, including access to educational materials, which became a motivation for the training. Participants also emphasised that the financial investment associated with the training supported them to understand its importance.

The participatory training model was described by the participants as very positive, especially as they rotated between facilitating and learning roles. They explained that it helped them to be active and strengthened their ownership of the learning.

There was a high level of involvement by all participants. It was very good to mix the groups with physicians and midwives (FGI 2).

Acceptability

The participants perceived the training programme as useful, describing it as interesting, innovative, and relevant, largely due to its strong practical components. The use of realistic simulation scenarios was perceived to strengthen problem-based learning and enhance the applicability of the training to clinical practice.

What was most difficult was vacuum extraction, but it was good that we could repeat the procedures because there were aspects we did not understand at first. (FGI 2)

The participants also highlighted that using mannequins and simulation scenarios was expected to contribute to improved health outcomes, including in supporting normal vaginal birth and preventing postpartum hemorrhage.

Participants expressed that they were feeling well prepared to facilitate the courses and to train colleagues and midwifery students using the materials provided.

We feel well prepared to lead the courses as long as we have the materials (FGI 1).

They perceived the training content positively, especially the pedagogical approach. They intended to apply low-dose, high-frequency training approaches to support continuous capacity building within clinical settings.

We must do this training continuously. We need to organise ourselves so that everyone receives the training —not only for those working in labour wards (FGI 2).

The training was perceived as important for both practicing midwives, midwifery students and faculty. The mixed group of physicians and midwives were perceived successful, as they could complement one another and it promoted a non-hierarchical learning environment, which enhanced team building and interprofessional learning.

It was good to mix groups of midwives and doctors. We complement each other. We appreciated that mix. If we doctors are not guided by skilled midwives, it is not good either (FGI 2).

The participants also expressed challenges, which included limited availability of materials across both academic and clinical settings, lack of adequate space and designated training areas, insufficient protected time for training, staff shortages, and the absence of established routines for continuing professional development. Further, the participants suggested that the training programme could be improved by restructuring training into shorter daily sessions spread over a greater number of days, as the volume of new knowledge and skills was considered substantial.

We were prepared for the scheduled time, but it would be better with shorter days across more days because one becomes very tired (FGI 1).

Discussion

This study demonstrates that simulation-based training for healthcare providers to function as facilitators in childbirth simulation was delivered with high fidelity, achieved the intended competency targets, and was perceived acceptable and engaging. These findings indicate the effectiveness of implementation of simulation-based learning in childbirth to become facilitators. The effectiveness is reflected in strengthened clinical competencies and increased readiness to assume facilitation roles.

To understand how this effectiveness was achieved, the findings are discussed using the integrated Promoting Action on Research Implementation in Health Services (i-PARIHS) framework (17). This framework provides a structured lens to examine how implementation outcomes are shaped by the characteristics of the innovation, the recipients who adopt or are affected by it, and the educational and clinical contexts in which implementation occurs, with facilitation acting as a key integrative mechanism.

Within i-PARIHS, facilitation is conceptualised as a core skill for successful implementation, bringing together the innovation, recipients, and context to enable the uptake and sustained use of new practices. Applying this framework allows for a deeper understanding of the conditions under which simulation-based training can effectively prepare healthcare providers to function as facilitators in childbirth simulation (17).

The innovation being implemented: Simulation-based learning

Within the i-PARIHS framework, the innovation encompasses both the characteristics of what is implemented and how it is perceived by those involved (17). In this study, simulation-based learning was perceived by participants as a new and innovative approach, where the opportunity to practice clinical skills within realistic simulation scenarios was described as a safe alternative to clinical practice. This enabled repeated practice in a protected environment and reduced fear of causing harm to real patients, creating psychological safety and effective learning. Similar perceptions have been reported in qualitative research among nursing and midwifery students and facilitators in Southern Ireland, where simulation was described as a safe, controlled environment that supports clinical skills and confidence building (32).

The simulation in our study demonstrated a clear relative advantage by supporting problem-based learning, reflection, and repeated skills rehearsal that aligned closely with identified learning needs. The importance of debriefing and reflection has also been emphasised in previous research where facilitators expressed a need for standardised training focused specifically on debriefing (33). This was reflected in the quantitative findings, which showed statistically significant knowledge gains in courses introducing unfamiliar clinical skills such as Vacuum assisted births, while courses covering well-known content showed high baseline scores and smaller gains, suggesting ceiling effects rather than limited effectiveness. Additionally, simulation-based learning also supported facilitation competence through co-facilitation and role switching between learner and facilitator. A study from nursing students in Korea showed that changing roles in simulation scenarios enhanced critical thinking and learning confidence (34). It thus seems like this experiential approach strengthened participants' confidence and preparedness to lead future simulation sessions, indicating that simulation-based learning was not only educationally effective and acceptable, but also well suited to preparing healthcare providers for facilitation roles within their clinical contexts.

Recipients: Midwives and medical doctors adopting the innovation

The i-PARIHS framework emphasises the importance of recipients´ referring to motivation, skills, and readiness for change (17). In this study, both midwives and medical doctors engaged with simulation-based training and expressed motivation to adopt simulation-based learning as a pedagogical approach. This motivation appeared to be driven by an awareness of limitation in prior training methods and a shared professional commitment to improving quality and safety in childbirth care. Comparable challenges have been documented in a study of midwifery education in the DRC, which reported that midwifery educators and clinical preceptors lacked training aligned with professional standards for adequate clinical practice (35).

Both quantitative and qualitative findings indicate that the training strengthened participants' competence and confidence. All participants achieved the predefined competency thresholds in the OSCEs, while qualitative findings reflected increased self-awareness, critical reflection on routine practices, and recognition of areas for improvement. These competencies are essential for clinical

practice and may contribute to improved patient experiences. Consistent with this, a study on vacuum-assisted birth in Tanzania found that women who were involved in decision-making, received respectful care, and were provided with clear information reported more positive birth experiences(36). In addition, the participants highlighted the benefit of the training including different categories of healthcare providers, offering an opportunity to enhance the interprofessional collaboration. Interprofessional collaboration in facilitation has been highlighted as a very important step for enhanced motivation for facilitation (37). Importantly, participants reported feeling prepared to facilitate simulation-based courses for colleagues and students, indicating a transition from learners to local implementers. This emerging facilitation ownership, characterised by enhanced confidence, perceived capability, and responsibility to transfer knowledge—represents a key recipient constructs within the i-PARIHS framework (38) and may constitute an important pathway toward sustainability, as implementation is more likely to be sustained when recipients perceive themselves as capable facilitators embedded within their own clinical and educational contexts. Our findings are consistent with the recent SimBegin® facilitator course study (39), in which structured facilitator training strengthened preparedness and confidence in leading simulation. Similarly, co-facilitation, role rotation, and structured materials in our study supported the transition to facilitation roles. Both studies further indicate that sustained simulation practice depends not only on facilitator competence but also on organisational support, psychological safety, and protected resources.

Context: Educational and clinical environment

Within the i-PARIHS framework, context refers to the organisational, cultural, and system-level conditions that influence how an innovation is implemented and sustained. In this study, both the educational and clinical environment played a central role in shaping the implementation of simulation-based learning (17). At the level of the inner context, several enabling factors were identified. These included the presence of a midwifery education programme with an established profile in simulation-based learning, integration between campus-based teaching and clinical practice sites, and a generally supportive learning culture. Such conditions likely contributed to the high levels of engagement and acceptability observed. The involvement of facilitators representing different levels of management also appeared to strengthen implementation efforts, a factor previously described as supportive of facilitation success (40). However, important structural constraints were also evident, including limited availability of mannequins and didactic materials, restricted physical space for simulation activities, and insufficient protected time and financial resources. These findings reflect varying levels of organisational readiness and a high degree of resource dependency, underscoring the vulnerability of implementation efforts in low-resource educational settings (41).

The outer context further shaped these conditions. Situated in eastern DRC, implementation occurs within a fragile health system characterised by competing clinical priorities, and limited opportunities for continuous professional development (20). Although simulation-based learning was perceived as highly valuable and relevant by participants, its long-term sustainability remains contingent on broader system-level investments and institutional support. Resource limitations in midwifery education have similarly

been identified as a persistent barrier to adequate clinical skills training in the DRC (35). A notable facilitating factor in this study was the provision of simulation equipment and training materials to all participating sites, accompanied by locally developed implementation plans and guidelines. These site-specific strategies reflect the i-PARIHS framework emphasising contextual tailoring and may strengthen the potential for sustained use of the innovation beyond the study period. (17).

Strengths and limitations

A major strength of this study is the mixed-methods design integrating quantitative measures of competency with qualitative insights into implementation processes. The use of pre- and post-tests, OSCE assessment strengthened the objectivity of outcome evaluation. Integration of qualitative findings enabled deeper understanding of how the intervention was delivered and experienced.

The inclusion of both foundational and advanced clinical content allowed comparison between areas where participants had prior knowledge and areas introducing new procedures. This provided insight into how simulation-based learning may contribute differently depending on baseline competence.

Limitations include the relatively small sample, which may have limited the statistical power to detect smaller knowledge changes. The absence of adjustment for multiplicity increases the risk of type I errors. Additionally, the study assessed short-term outcomes only; long-term retention of competence and impact on clinical practice were not evaluated. Although findings were organised according to implementation domains, these domains are conceptually interrelated, and categorisation occasionally required interpretative judgement. Finally, the specific educational and health system context may limit transferability to settings with different organisational conditions.

Conclusion

This study demonstrates that structured simulation-based training can effectively prepare healthcare providers to assume facilitator roles within childbirth education. The intervention strengthened their clinical competence, reflective capacity, and confidence to lead simulation activities. Experiential components such as co-facilitation and role rotation supported active learning and the development of pedagogical skills beyond technical proficiency. The findings highlight the importance of integrating facilitator preparation in simulation programmes to support sustainable capacity building. However, the study also showed that continued implementation requires protected training time, access to appropriate resources, and institutional support. Embedding facilitator development within educational structures may therefore represent a key strategy for strengthening simulation-based learning in low-resource health professions education.

Declarations

Ethics approval and consent to participate

Each participant was informed of the study both through written and oral information prior to the study. At the time of the study informed consent was gained from each participant both written and oral. The National Ethical Committee of Public Health; CNES 001/DPSK/201PP/2022, Bukavu DRC approved the study. All methods, including procedures to obtain informed consent from all study participants, were carried out according to relevant regulations as well as the Helsinki Declaration, 1975. The consent for publication is clearly stated in the consent form and was obtained by the participants in the study.

Consent for publication

All participants consented to the publication of the study.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

FT: Data collection, Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **ECL:** Writing – review & editing, , Methodology, Investigation, Formal analysis, conceptualization. **MBe:** Data collection, Writing – review & editing, Validation, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **ON:** Ethical approval, Writing – review & editing, Validation, Resources, Conceptualisation. **MBo:** Writing – review & editing, , Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

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Data Availability

All data generated and/or analysed during the current study are available from the corresponding author on reasonable request.

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