ÉDITORIAL

Renforcer les systèmes de données pour promouvoir la santé et les droits sexuels et reproductifs en Afrique subsaharienne

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Le développement de la santé et des droits sexuels et reproductifs (SDSR) en Afrique subsaharienne est fondamentalement entravé par la « pauvreté des données de santé »[1]. Si de nombreux pays à revenu élevé ont réalisé des progrès significatifs dans le renforcement de leurs systèmes de données de santé, l'Afrique subsaharienne continue de faire face à d'importantes lacunes[1–3]. Malgré le besoin crucial de pratiques fondées sur des données probantes, le paysage régional des données est caractérisé par une méconnaissance généralisée de la valeur intrinsèque de données exactes. De nombreux pays de la région ne disposent pas de recensements de population réguliers, de dossiers de santé fiables ni de systèmes fonctionnels d'état civil et de statistiques vitales.

L'exactitude des données est souvent compromise par une réticence profondément ancrée des populations à fournir des informations personnelles. Dans de nombreux contextes africains, les tabous culturels, les croyances religieuses et la méfiance envers les « étrangers » entraînent des taux de refus élevés lors des enquêtes menées auprès des ménages et dans les établissements de santé. Par exemple, une étude menée en Afrique du Sud a mis en évidence comment des femmes peuvent refuser de parler de santé reproductive en raison d'une opposition religieuse ou par crainte d'être jugées par les chercheurs[4]. Les données sont parfois sujettes à la falsification et au biais de désirabilité sociale. Les personnes interrogées « apprennent » souvent à répondre de manière à minimiser la longueur des questionnaires, par exemple en déclarant moins de partenaires sexuels pour éviter les questions complémentaires.[5]

Plus grave encore, la crainte de répercussions juridiques ou sociales conduit à la dissimulation active d'informations sensibles par les individus et les établissements de santé. Des personnes ont déclaré avoir menti sur leur statut sérologique ou sur les violences sexistes qu'elles ont subies par crainte d'une intervention policière ou de la stigmatisation sociale.[4]

Même lorsque des données sont disponibles, on observe une minimisation et une non-utilisation systématiques des informations factuelles pertinentes pour la prise de décision et la planification stratégique. L'institutionnalisation du suivi fondé sur les données demeure faible et les plans annuels sont souvent élaborés sans tenir compte des informations sanitaires courantes.[6] Dans de nombreux cas, la planification fondée sur des données probantes est supplantée par l'ingérence politique et le népotisme, où les intérêts politiques — plutôt que les données empiriques — déterminent quels programmes de santé sont mis en œuvre et qui est nommé pour les diriger.[7] Sans s'attaquer à ces barrières culturelles et structurelles, les systèmes de données continueront de produire des informations de mauvaise qualité qui ne permettront pas d'améliorer significativement les résultats en matière de santé sexuelle et reproductive dans la région.[1,8]

Depuis la Conférence internationale sur la population et le développement (CIPD) du Caire en 1994 et jusqu'aux Objectifs de développement durable (ODD) pour 2030, la santé sexuelle et reproductive est reconnue comme un droit humain fondamental.[9–11] Ce droit est désormais inscrit dans les politiques nationales de santé et les cadres juridiques de nombreux pays.

Le droit à la santé sexuelle et reproductive comprend l'accès à la contraception, aux soins de fertilité et d'infertilité, aux services de santé maternelle et périnatale, à la prévention et au traitement des infections sexuellement transmissibles, à la protection contre les violences sexuelles et sexistes, et à l'éducation à des relations saines et sans risque.[12] comprend également le droit à l'information et la capacité de faire des choix éclairés concernant sa vie reproductive.

Lorsque cet accès est retardé ou refusé, les conséquences peuvent être graves, notamment le décès, un handicap permanent et des difficultés socio-économiques. Pour que ces droits se concrétisent, les systèmes de santé ont besoin de systèmes de données robustes. Des données précises, actualisées et

ORIGINAL RESEARCH ARTICLE

Effectiveness of simulation-based continuing education in neonatal resuscitation among Moroccan midwives: A quasi-experimental study

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Abstract

Neonatal mortality remains a critical public health issue, particularly in resource-limited settings. Simulation-based programs such as Helping Babies Breathe (HBB) have proven effective in strengthening midwives' knowledge and skills in neonatal resuscitation, yet no study has evaluated their impact among practicing Moroccan midwives. The objective of this study was to assess the effectiveness of HBB training on satisfaction, self-efficacy, theoretical knowledge, one-year knowledge retention, and technical skills among practicing Moroccan midwives. A quasi-experimental pre-post study was conducted with 96 midwives. The intervention included a didactic session, hands-on practice, and formative simulation. Satisfaction, self-efficacy, and knowledge were measured through questionnaires; technical skills were evaluated using OSCE checklists for the Golden Minute and positive pressure ventilation. Satisfaction was 100%, and full self-efficacy increased markedly post-training. Knowledge improved significantly and remained stable at follow-up. Technical skills showed high scores with minimal failure rates. Knowledge moderately correlated with ventilation performance. In conclusion, HBB simulation-based training significantly enhances and sustains neonatal resuscitation competencies among Moroccan midwives, supporting its systematic integration into continuous professional development. *(Afr J Reprod Health 2026; 30 [12]: 28-37).*

Keywords: Neonatal resuscitation; Simulation training; Helping Babies Breathe; Technical skills; Knowledge; self-efficacy

Résumé

La mortalité néonatale reste un problème majeur de santé publique, particulièrement dans les contextes aux ressources limitées. Les programmes basés sur la simulation, tels que « Helping Babies Breathe » (HBB), ont prouvé leur efficacité pour renforcer les connaissances et les compétences des sages-femmes en réanimation néonatale, mais aucune étude n'a encore évalué leur impact chez les sages-femmes marocaines en exercice. L'objectif de cette étude était d'évaluer l'efficacité de la formation HBB sur la satisfaction, le sentiment d'auto-efficacité, les connaissances théoriques, le maintien des connaissances à un an et les compétences techniques chez les sages-femmes marocaines en activité. Une étude quasi-expérimentale avant-après a été menée auprès de 96 sages-femmes. L'intervention comprenait une session didactique, une pratique supervisée et une simulation formative. La satisfaction, le sentiment d'auto-efficacité et les connaissances ont été mesurées par questionnaires ; les compétences techniques ont été évaluées à l'aide de grilles ECOS pour la « Minute d'or » et la ventilation à pression positive. La satisfaction était de 100 %, et le sentiment d'auto-efficacité a nettement amélioré après la formation. Les connaissances se sont significativement améliorées et sont restées stables au suivi. Les compétences techniques ont montré des scores élevés avec un taux d'échec minimal. Les connaissances étaient modérément corrélées à la performance en ventilation. En conclusion, la formation basée sur la simulation HBB améliore significativement et durablement les compétences en réanimation néonatale des sages-femmes marocaines, ce qui plaide en faveur de son intégration systématique dans le développement professionnel continu.*(Afr J Reprod Health 2026; 30 [12]: 28-37).*

Mots-clés : Réanimation néonatale ; Formation par simulation ; Helping Babies Breathe ; Compétences techniques ; Connaissances ; Sentiment d'Auto-efficacité

Introduction

Neonatal mortality remains a major global public health issue. It continues to represent a substantial proportion of all deaths among children under five years of age. According to recent United Nations estimates, it accounts for approximately 47% of all under-five deaths, representing nearly 2.3 million deaths annually, with the vast majority occurring in low- and middle-income countries.[1] Birth asphyxia

and trauma contribute to approximately 10% of these neonatal deaths and are a leading cause of long-term morbidity, including hypoxic-ischemic encephalopathy and neurodevelopmental impairment.[2]

Midwives, as frontline health professionals, play a crucial role in emergency obstetric and newborn care. They are often the first responders during delivery, and their prompt, evidence-based interventions are essential to newborn survival. However, numerous studies indicate that healthcare providers, including midwives, may lack up-to-date neonatal resuscitation competencies, particularly in settings where structured continuing education is limited.[3–5]

Approximately 10% of newborns require respiratory assistance at birth, and nearly 1% require advanced resuscitation to establish adequate cardiorespiratory function.[6,7] Positive pressure ventilation (PPV) is the most critical intervention and can successfully resuscitate the majority of newborns who fail to breathe spontaneously.[8,9] Delivering PPV effectively requires hands-on proficiency. Simulation-based learning has emerged as a highly effective educational strategy to strengthen both technical and non-technical skills among healthcare professionals. It enables realistic clinical practice without patient risk, while promoting active learning, clinical reasoning, stress management, and teamwork.[10]

The Helping Babies Breathe (HBB) program was initially developed to standardize neonatal resuscitation training in resource-limited settings. HBB provides a structured, simulation-based approach that prepares providers to manage newborn respiratory distress promptly. Its effectiveness has been demonstrated across diverse low-resource contexts, with significant reductions in early neonatal mortality and fresh stillbirths.[11–13] The World Health Organization strongly recommends simulation-based continuing education for newborn care providers to maintain competency and improve clinical outcomes, particularly in settings with high neonatal mortality.[14]

In Morocco, neonatal mortality has declined over the past decades but remains a pressing public health priority, particularly in regions with uneven access to specialized newborn care. Midwives constitute the backbone of the maternal and newborn health workforce, yet opportunities for standardized, simulation-based continuing education in neonatal resuscitation remain limited.[15]

To address this gap, the objective of this study was to assess the effectiveness of a simulation-based HBB training program on satisfaction, self-efficacy, theoretical knowledge, one-year knowledge retention, and technical skills among practicing Moroccan midwives.

Methods

Study design and setting

This quasi-experimental, single-cohort longitudinal study employed repeated measures to evaluate the impact of a simulation-based training program on neonatal resuscitation competencies. The study was conducted from April 2024 to April 2025. The training session took place in a private training facility in Casablanca, Morocco. Participants were practicing midwives recruited from various healthcare facilities across multiple regions of Morocco, including health centers with delivery units and local, provincial, and regional hospitals equipped with delivery rooms.

Participants and recruitment

The sample comprised 96 licensed midwives recruited via a call for continuous professional development (CPD) coordinated by national midwives' association. Inclusion criteria were: (1) being a certified midwife practicing in a facility with a delivery room; (2) willingness to participate in the training and complete all assessment timepoints (pre-test, 6-month and 1-year follow-ups); and (3) provision of written informed consent.
Midwives who had completed advanced neonatal resuscitation training (e.g., HBB Provider certification) within the two years preceding the study were excluded. This recruitment strategy yielded a homogeneous cohort exposed to identical training conditions.

Training intervention

The educational intervention consisted of a one-day, in-person training session based on the complete *Helping Babies Breathe* (HBB) 2nd edition

curriculum. The HBB program was selected over the broader World Health Organization *Essential Newborn Care* (ENC) Course 2nd edition due to its focused, simulation-ready framework specifically designed for neonatal resuscitation, which aligned optimally with the CPD objectives and the single-day format.

The training commenced with a welcome address, followed by a presentation of the study objectives and the signing of the informed consent form. To guarantee anonymity while enabling longitudinal data linkage across follow-up waves, each participant was assigned a unique alphanumeric identifier. Subsequently, all participants completed a pre-test to assess baseline theoretical knowledge. First, participants attended a two-hour theoretical module featuring a video demonstration of neonatal resuscitation techniques in accordance with the HBB program (2nd edition). Participants were then divided into working groups of six, each supervised by one certified HBB instructor. During these hands-on workshops, participants practiced neonatal resuscitation techniques, including initial care steps and positive pressure ventilation (PPV), strictly following the HBB curriculum (2nd edition). Practical exercises were conducted using NeoNatalie medium-fidelity manikins.

In the afternoon, all participants engaged in a four-hour integrated simulation session. A standardized clinical scenario was enacted, simulating the management of a newborn presenting with respiratory distress in a delivery room. Immediately following the simulation, participants underwent three concurrent assessments:
A technical skills checklist for mask ventilation,
Objective Structured Clinical Examinations (OSCE A and OSCE B),An immediate post-training test evaluating theoretical knowledge acquisition.

Data collection instruments

Data were collected using four instruments, all derived from the official HBB 2nd edition toolkit and available in validated French versions:

***Sociodemographic and Professional Profile Questionnaire*:** Captured age, years of experience, type of practice facility and city.

***Theoretical Knowledge Assessment*:** An 18-item multiple-choice questionnaire extracted from the validated HBB 2nd edition toolkit. The French version has been officially translated and published, ensuring linguistic and content validity for French-speaking midwives.

***Technical skills and OSCE checklists*:** The PPV checklist (14 binary items) and the Objective Structured Clinical Examinations (OSCEs) were adapted from the HBB toolkit to align with Moroccan clinical protocols while preserving core competency items. OSCE A (12 points, pass ≥9) assessed initial resuscitation steps; OSCE B (23 points, pass ≥17) evaluated the complete HBB algorithm through PPV initiation and ventilation improvement. Both were scored by trained assessors using standardized rubrics. Practical assessments were evaluated by independent, HBB-certified instructors who were not directly affiliated with the participants' home institutions, ensuring objective scoring and minimizing performance bias.

***Satisfaction and self-efficacy questionnaire*:** A 4-point Likert scale adapted from Helping Babies Breathe (HBB) feedback tools, administered pre- and post-training to measure perceived confidence and training relevance. The self-efficacy score was calculated as the mean of participants' responses across all items, with higher scores indicating greater perceived confidence in neonatal resuscitation skills. The evaluation was structured according to the first two levels of Kirkpatrick's model:[16] Reaction (satisfaction and self-efficacy) and Learning (theoretical knowledge and technical skills).

Follow-up assessments and data management

Theoretical knowledge retention was assessed at 6 and 12 months post-training. Follow-up questionnaires were self-administered remotely via Google Forms, with access links distributed through email and WhatsApp. To maintain longitudinal data linkage while preserving anonymity, each participant was assigned a unique alphanumeric code at enrollment.

This code was used across all assessment waves without collecting personal identifiers. Missing follow-up data were handled using complete-case analysis for repeated-measures models; baseline characteristics of participants with complete follow-up were compared to dropouts to assess potential attrition bias.

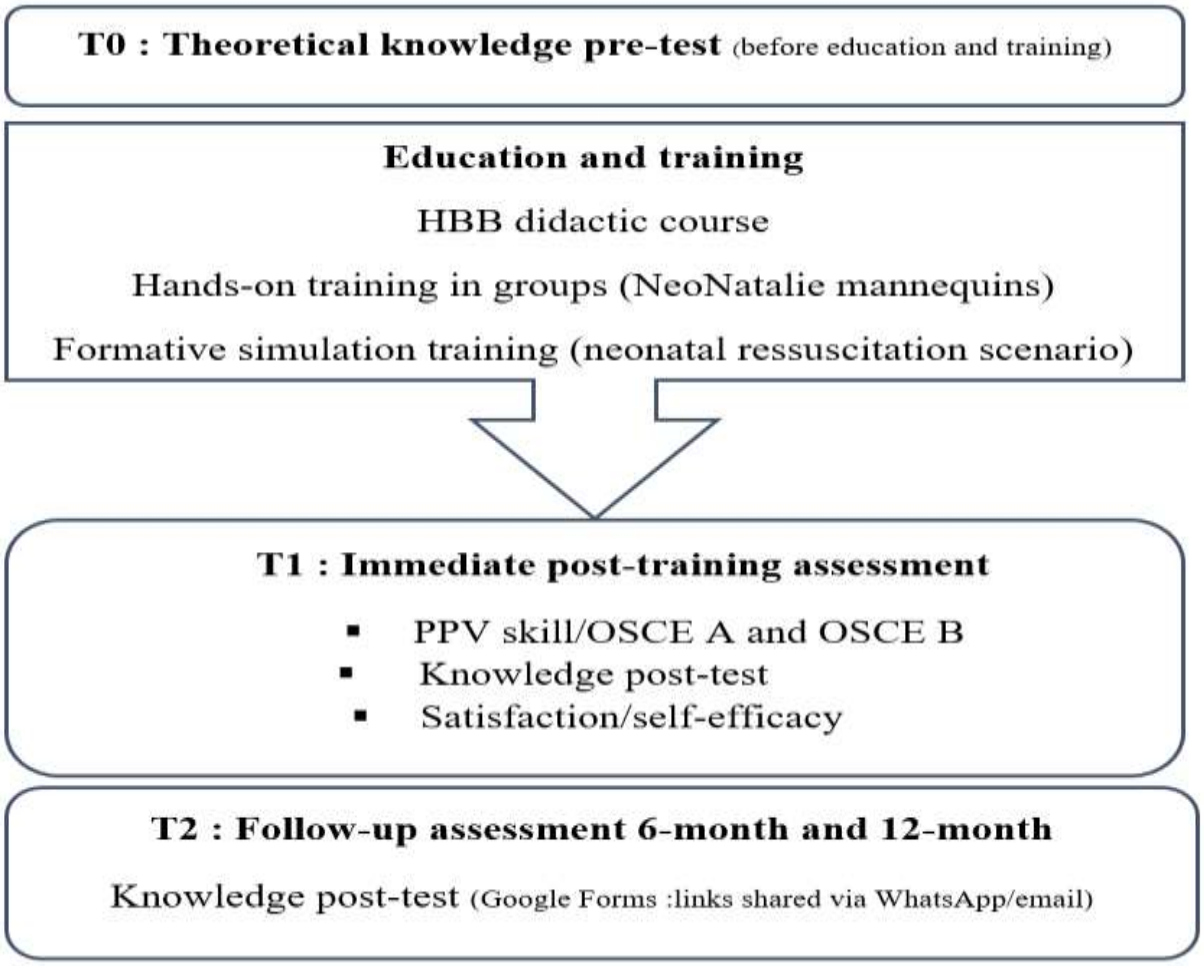

Figure 1: Study diagram

Statistical analysis

Statistical analyses were performed using SPSS software (version 26.0). The distribution of quantitative variables was assessed using the Shapiro-Wilk test to determine normality. Variables with a normal distribution were reported as means with standard deviations. To compare the scores obtained at four measurement points (pre-test, immediate post-test, 6-month post-test, and 1-year post-test), a repeated measures of variance (ANOVA) was performed. In case of statistical significance, Bonferroni post-hoc tests were applied to determine pairwise differences between the measurement time points. Correlations between knowledge scores and practical performance were assessed using Pearson correlation coefficient, or Spearman's rank correlation coefficient if the distribution was not normal. The statistical significance threshold was set at $p < 0.05$.

Ethical considerations

The study was approved by the Ethics Committee for Biomedical Research, Faculty of Medicine and Pharmacy, Cadi Ayyad University, Marrakech, Morocco (Approval No. 103/2024). Written informed consent was obtained from all participants. Anonymity was safeguarded through coded identifiers, and all electronic data were stored on password-protected servers accessible only to the principal investigator. Data were permanently deleted upon study completion, in accordance with national ethical guidelines.

Results

Sociodemographic characteristics

The study sample consisted of 96 participants, all practicing midwives. The mean age of the participants was 30.0 years (SD = 5.4), with a range from 23 to 52 years. Participants had an average of 7.8 years of professional experience (SD = 5.14), ranging from 1 to 27 years (Table 1).In terms of geographical distribution, Participants practiced in various cities across Morocco: Casablanca (38.5%), Rabat (21.9%), Fes (15.6%), Marrakech (9.4%), Tangier (8.3%), and Agadir (6.3%). This geographical distribution reflects the diversity of practice settings included in this study. Regarding the type of practice facility, 53 participants (55.2%) worked in Health center with delivery unit, 25 (26.0%) in provincial hospitals, and 18 (18.8%) in regional hospitals.

Satisfaction and self-efficacy

All participants (100%) reported being very satisfied with the simulation-based training. Regarding self-efficacy in basic neonatal resuscitation, participants demonstrated a significant improvement in their perceived neonatal resuscitation skills following the simulation-based training. As shown in Table 2, the mean score increased from 1.1 (SD = 0.3) before the training to 2.7 (SD = 0.7) after the training, yielding a mean difference of 1.6 (SD = 0.8; SEM = 0.1). Analysis using a paired-samples t-test revealed that this difference was highly significant ($t(95) = 18.9$; $p < 0.001$; 95% CI [1.4–1.7]), confirming the effectiveness of simulation in improving participants' perceived skills.

Evolution of theoretical knowledge

Table 3 shows the results of repeated-measures ANOVA conducted to assess the evolution of neonatal resuscitation knowledge across four time points (pre-test, immediate post-test, 6-months post-intervention, and 1-year post-intervention). The analysis revealed a statistically significant effect of time on knowledge scores ($F(3, 285) = 82.1$, $p < 0.001$), with a large partial eta squared ($\eta^2 = 0.5$), indicating a substantial effect size. Mauchly's test indicated a violation of sphericity ($W = 0.0$, $p < 0.001$); therefore, Greenhouse-Geisser corrections were applied. Post hoc Bonferroni-adjusted comparisons showed a statistically significant increase in knowledge scores from the pre-test ($M = 13.6$) to the immediate post-test ($M = 17.4$), $p < 0.001$. Knowledge retention remained high at 6 months ($M = 17.2$) and 1 year ($M = 17.4$), with no statistically significant decline observed between these two time points.

Practical performance assessment

Descriptive statistics for practical scores are presented in Table 4. The mean score obtained for the self-inflating bag ventilation (SIBV) technique was 12.2 ± 1.2 out of a maximum of 14, with scores ranging from 10 to 14, indicating a generally high level of skill acquisition. For OSCE A, the mean score was 10.5 ± 1.1 out of 12, with scores ranging from 8 to 12. Three participants (3.1%) scored below the pass mark of 9/12. For OSCE B, the mean score was 20.2 ± 2.3 out of 23, with scores ranging from 15 to 23. Eight participants (8.3%) scored below the minimum required score of 17 out of 23. These results suggest that participants' practical performance was generally satisfactory, despite a small proportion demonstrating difficulties with specific aspects of the skills.

Pearson correlation between knowledge and practical performance

Table 5 shows that the average post-test knowledge score was positively and significantly correlated with the PPV technique ($r = 0.3$; $p < 0.01$), indicating that higher theoretical knowledge is associated with better performance in bag-valve-mask ventilation. However, no significant correlation was observed between the average post-test knowledge score and OSCE A scores ($r = 0.2$; $p = 0.132$) or OSCE B scores ($r = -0.1$; $p = 0.292$). Regarding the relationship between practical performance measures, the PPV technique was significantly correlated with OSCE A scores ($r = 0.3$; $p < 0.05$), but not with OSCE B scores ($r = -0.2$; $p = 0.091$). The correlation between OSCE A and OSCE B scores was negative and not statistically significant ($r = -0.1$; $p = 0.197$).

Table 1: Sociodemographic characteristics of participants

Variable	M (n=96)	SD	Min	Max
Age	30.0	5.4	23	52
Experience (years)	7.8	5.1	1	27
Type of practice facility n (%)				
Health center with delivery unit	53 (55.2%)			
Provincial hospital	25 (26.0%)			
Regional hospital	18 (18.8%)			
City of practice n (%)				
Casablanca	37 (38.5%)			
Rabat	21 (21.9%)			
Fes	15 (15.6%)			
Tangier	8 (8.3%)			
Marrakech	9 (9.4%)			
Agadir	6 (6.3%)			

M: Mean; SD: standard deviation

Table 2: Paired-samples t-test: comparison of self-efficacy scores across time points

Paired comparison	M	SD	SEM	Mdif	SDdif	SEMdif	95% CI	t	P value
Before simulation	1,1	0,3	0,0	_	_	_	_	_	_
After simulation	2,7	0,7	0,1	1.6	0.8	0.1	1.4 – 1.7	18.9	<0.001

M: Mean; SD: standard deviation; SEM: standard error of mean; Mdif: Mean Difference; SDdif: SD of difference; SEMdif: SEM of difference; CI: Confidence Interval. t: t student test

Table 3: Mean knowledge scores across assessment time-points.

Time-point assessment	M(CI 95%)	SD	SEM
Pre-test	13.6 (12.8–14.4)	3.9	0.4
Immediate post-test	17.4(17.2–17.6)	1	0.1
6 months post-intervention	17.2(17–17.4)	1.0	0.1
1 year post-intervention	17.4(17.2–17.6)	0.8	0.1

M:Mean; SD: standard deviation; SEM: standard error of mean; CI: Confidence Interval.

Table 4: Descriptive statistics of neonatal resuscitation technical performance (PPV technique, OSCE A, and OSCE B)

Variables	M ± SD	Min	Max	Percentage below passing grade
PPV technique (score/14)	12.2 ± 1.2	10	14	
OSCE A (score/12)	10.5 ± 1.1	8	12	3 participants (< 9/12)
OSCE B (score/23)	20.2 ± 2.3	15	23	8 participants (< 17/23)

PPV: Positive Pressure Ventilation; OSCE: Objective Structured Clinical Examination; M: Mean; SD; standard deviation.

Table 5: Pearson Correlations between post-test theoretical knowledge scores and practical performance scores (PPV, OSCE A, and OSCE B)

Variables	Knowledge post-test score	PPV technique	OSCE A	OSCE B
Knowledge post-test score	1	0.3**	0.2	-0.1
PPV technique	0.3	1.0	0.3*	-0.2
OSCE A	0.2	0.3	1,0	-0.3
OSCE B	-0.1	-0.2	-0.1	1.0

PPV: Positive Pressure Ventilation; OSCE: Objective Structured Clinical Examination.

- **p < 0.05 (two-tailed)*
- ***p < 0.01 (two-tailed)*

These findings indicate the presence of significant associations between certain theoretical and practical components, particularly between knowledge scores and PPV performance.

Discussion

The present study evaluated the effects of a simulation-based neonatal resuscitation training program, specifically the Helping Babies Breathe (HBB) intervention, on Moroccan midwives, with a focus on self-efficacy, knowledge acquisition and retention, and technical skills.The diversity of practice settings ranging from health center with delivery unit to regional hospitals reflects the broad applicability of the HBB training program across different levels of the Moroccan health system.Overall, the findings suggest that participation in the simulation-based training was associated with improvements in perceived self-efficacy, theoretical knowledge, and practical skills. However, given the quasi-experimental design and absence of a control group, these results should be interpreted as associations rather than evidence of causal effectiveness.

The study sample consisted exclusively of female midwives with relatively homogeneous age and professional experience. While these characteristics are broadly consistent with profiles reported in similar studies, they do not fully reflect the diversity of the Moroccan midwifery workforce. Moreover, the predominance of participants from central regions may limit the external validity of the findings. Therefore, comparisons with international studies should be approached cautiously, Furthermore, challenges such as knowledge and skill retention, standardized training protocols, and limited training opportunities for healthcare providers have been identified as barriers to effective neonatal resuscitation training programs.[17]

The observed increase in self-efficacy is consistent with the educational mechanisms underpinning simulation-based learning, particularly experiential learning, deliberate practice, and immediate feedback.[18-20] These elements are known to enhance learners' confidence in performing clinical tasks. However, self-efficacy remains a subjective construct and may not accurately reflect actual competence.[21] Variability in clinical exposure, supervision, and opportunities to apply skills in practice may further influence perceived confidence.[22,23] However, the relationship between self-efficacy and actual clinical competence remains debated, with some studies reporting strong correlations and others showing rapid skill decay post-training.[22,23]

In terms of knowledge outcomes, the results demonstrate a substantial immediate post-training improvement, followed by relative stability at six months and one year. This pattern may indicate that simulation-based training supports medium-term knowledge retention.[24-26] However, several factors should be considered when interpreting these findings.

First, the high post-intervention scores suggest a potential ceiling effect, which may obscure subtle declines over time. Second, the absence of data on refresher training or informal clinical reinforcement during the follow-up period limits the interpretation of long-term retention. Existing evidence indicates that both knowledge and skills tend to decay over time in the absence of reinforcement, [27,23] highlighting the importance of continuous and structured refresher strategies.

The improvement in technical skills, as reflected in PPV and OSCE assessments, suggests that participants were able to acquire essential competencies in neonatal resuscitation. Nevertheless, the persistence of suboptimal performance among a subset of participants indicates variability in skill acquisition and reinforces the need for repeated practice and supervision. This is particularly relevant in neonatal resuscitation, a high-stakes but low-frequency clinical situation where skill decay is well documented.[27,22]

The moderate correlation observed between theoretical knowledge and performance in specific tasks, alongside the absence of correlation with OSCE scores, underscores the multifactorial nature of clinical competence. Practical performance is not solely determined by knowledge but also depends on psychomotor abilities, cognitive load management, teamwork, and environmental factors. In this regard, self-efficacy may theoretically mediate the translation of knowledge into practice, though this relationship warrants formal mediation analysis in future studies.[28,29]

From a health systems perspective, these findings have important implications for maternal and neonatal care in Morocco. Variability in training opportunities and clinical exposure may contribute to gaps in preparedness among midwives managing neonatal emergencies. Simulation-based programs such as the HBB intervention have been widely implemented in low- and middle-income countries to standardize essential newborn care competencies.[30-33] However, accumulating evidence suggests that one-time training interventions, even when simulation-based, are insufficient to produce sustained improvements in clinical practice or neonatal outcomes.[31,32] Therefore, effective implementation requires integration into a broader system of continuous professional development, including periodic refresher training, supportive supervision, and workplace-based practice.[34,35,36]

Several limitations should be acknowledged. The use of convenience sampling introduces potential selection bias and limits representativeness. The absence of a control group precludes causal inference, and reliance on self-reported measures may introduce response bias. Additionally, the potential ceiling effect in knowledge scores and the lack of long-term assessment of technical skills constrain the interpretation of retention outcomes. These limitations highlight the need for cautious generalization of the findings to the national context. Future research should focus on evaluating the impact of simulation-based training on clinical outcomes, including neonatal morbidity and mortality, as well as identifying optimal implementation strategies, such as the frequency and format of refresher training. Furthermore, studies using controlled designs and more representative samples are needed to better assess the effectiveness, scalability, and sustainability of such interventions within the Moroccan healthcare system. Taken together, these findings support the integration of simulation-based training into continuing education frameworks, while highlighting the need for longitudinal, implementation-focused research.

Conclusion

This quasi-experimental study indicates that a simulation-based HBB training program was associated with meaningful improvements in theoretical knowledge, self-efficacy, and foundational resuscitation skills among Moroccan midwives, with knowledge retention sustained at six-month and one-year follow-ups. However, given the single-cohort design without a control group and the absence of clinical outcome data, these findings should be interpreted as evidence of enhanced learning outcomes rather than proven clinical effectiveness or transferability to routine practice. The results suggest that integrating simulation-based training into continuing professional development frameworks may strengthen midwives' preparedness for neonatal emergencies. Nevertheless, translating these educational gains into sustained improvements in newborn care quality and safety will likely require systematic implementation strategies, including periodic refresher training, workplace-based supervision, and rigorous evaluation of clinical impact. Future controlled studies measuring actual resuscitation performance and neonatal outcomes are needed to confirm the long-term clinical value of such interventions in resource-limited settings.

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Conflict of interest

The authors declare no conflict of interest.

Authors' contributions

S.A. conceptualized and designed the study, coordinated the simulation-based training intervention, and drafted the original manuscript. K.T. and W.L. contributed to data collection, participant recruitment, and field supervision during the quasi-experimental phase. S.L. performed statistical analysis and data interpretation. M.L. provided methodological oversight, supervised the overall project, and critically revised the manuscript for important intellectual content. All authors reviewed the final version, approved the manuscript for publication, and agree to be accountable for all aspects of the work.

Data availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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