Integration of CBL-PBL Teaching Method with Scenario Simulation for Enhanced Midwifery Training in Postpartum Hemorrhage: A Quasi-experimental Study

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Article

Integration of CBL-PBL Teaching Method with Scenario Simulation for Enhanced Midwifery Training in Postpartum Hemorrhage: A Quasi-Experimental Study

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Abstract: Background: Postpartum hemorrhage (PPH) remains the leading cause of maternal mortality globally, necessitating focused attention from midwifery professionals. To mitigate severe complications and improve maternal outcomes, regular and effective training in PPH rescue techniques is essential. **Aim**: To assess the efficacy of the combination of case-based learning (CBL) and problem-based learning (PBL) with simulation teaching methods to enhance the technical proficiency of midwifery trainees in managing PPH. **Methods**: This quasi-experimental study included 76 trainees who received PPH training at Peking University Third Hospital from March to July 2023; they were divided into two groups: the control group (n = 50), which followed traditional simulation training methods, and the research group (n = 26), which used a combination of CBL-PBL and scenario simulation. After training, all participants completed a questionnaire to evaluate their satisfaction with the training program and to measure improvements in clinical thinking, practical skills, relevant knowledge, team cooperation, and management abilities. Statistical analysis was conducted using unpaired t-tests and chi-square tests to compare the groups. **Findings:** The combination of CBL-PBL with scenario simulation was found to be highly satisfactory compared with the traditional simulation training. This approach significantly enhanced self-assessed skills among midwifery trainees in the research group. Additionally, a majority of trainees expressed a preference for the inclusion of regular simulation exercises and detailed discussions on PPH cases in future training sessions. **Conclusion**: Combining CBL-PBL with simulation practice is a more effective teaching method for PPH management training than traditional methods. Future studies should explore the implementation of regular PPH rescue skill training and its effectiveness in real clinical settings to substantiate these findings.

Keywords: case-based learning method; problem-based learning method; scenario simulation teaching; postpartum hemorrhage; midwifery trainees; continuing education

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Impact Statement

Integrating case-based and problem-based learning approaches with simulation practice represents a more efficacious pedagogical approach for enhancing PPH management training.

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Plain Language Summary

Issue

Postpartum hemorrhage (PPH) continues to be the primary cause of maternal mortality worldwide. Comprehensive and proficient training in PPH management techniques is imperative for all midwifery practitioners.

What Is Already Known

The utilization of simulation teaching in PPH technical training is widespread. However, its effectiveness may be hindered by a limited variety of scenarios and inflexible scripts, potentially compromising its ability to fully address the objectives of training.

What This Paper Adds

The CBL-PBL teaching method, combined with scenario-simulation practice, yielded a significantly higher level of satisfaction and facilitated enhanced self-assessment of skills among trainees in midwifery.

Introduction

Postpartum hemorrhage (PPH) stands as the predominant cause of maternal mortality globally, constituting approximately a quarter of all maternal deaths(Bienstock et al., 2021). The maternal mortality rate serves as a pivotal gauge of healthcare standards within a nation. In China, PPH remains a primary contributor to maternal mortality, with an escalating incidence of severe PPH attributed to factors such as advancing maternal age and an increasing prevalence of high-risk pregnancies. Consequently, preventing and effectively managing PPH is imperative for midwives to diminish maternal mortality rates and ensure the well-being of both mothers and infants. Recognizing this urgency, health departments nationwide have ordered regular training sessions on PPH rescue techniques for midwives and obstetricians(Yang et al., 2024).

Although scenario-based simulation teaching(Satin, 2018), an educational approach wherein trainers design simulated scenarios for trainees to engage in role-playing, simulate processes, acquire knowledge, and enhance skills within controlled environments, is widely utilized in PPH technical training, its effectiveness may be hampered by limited scenario variety and rigid scripts, potentially undermining its ability to fully address training objectives.

Case-based learning (CBL)(Jamkar et al., 2008), rooted in the analysis of medical records to recreate real-life clinical scenarios, empowers trainees to identify and explore new learning avenues. Concurrently, problem-based learning (PBL)(Smits et al., 2003), a learner-centered approach characterized by independent study, group discussions, and collaborative problem-solving, has demonstrated efficacy in clinical teaching.

This study aims to combine the educational principles of CBL and PBL with traditional simulation training, aiming to optimize the efficacy of PPH technical training. Through this integrated approach, we aspire to provide midwifery trainees with a more holistic and practical training experience, thereby enhancing their proficiency in PPH management and contributing to the reduction of maternal mortality rates.

Materials and Methods

Participants

The study enrolled 76 trainees who underwent PPH training between March and July 2023. Participants were required to be college graduates with at least 1 year of clinical experience. The mean age of the participants was 37.7 ± 5.8 years. Among them, 29 were midwives and 47 were obstetricians; 30 participants were senior professionals while 46 were junior or intermediate professionals. Additionally, 26 trainees were from secondary maternity institutions, while 50 were from tertiary maternity institutions.

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Study Design

This study used a quasi-experimental design. Over 5 months, three training programs were conducted, each accommodating 24–26 participants. The initial two sessions followed traditional simulation training methods and served as the control group, totaling 50 participants. In contrast, the final session incorporated CBL and PBL combined with scenario simulation and constituted the research group, comprising 26 participants.

Control Group

Trainers in the control group initiated the training with a comprehensive group lecture to elucidate key concepts related to PPH, including fluid resuscitation and blood transfusion management. Subsequently, the participants were randomly assigned to groups of 5 or 6 individuals each for role-playing exercises. Each group comprised a midwife, a circulating nurse, a frontline doctor, a second-line doctor, a third-line doctor, and a head nurse (if necessary). Simulated scenarios were provided, incorporating general patient information, prenatal examination results, and delivery details. Trainees then executed their roles based on the progression of the medical condition as directed by the instructor. Responsibilities varied among roles, including tasks such as childbirth assistance, forceps delivery, and uterine balloon placement. The training was conducted at the Obstetric Skills Training Center, which offered resources such as simulated mannequins, electrocardiogram monitoring simulators, PPH rescue materials (e.g., delivery kits, forceps, balloons, gauze pads, and catheters), and simulated drugs. Throughout the training, SimMom simulation mannequins were utilized, with an assistant adjusting the electrocardiogram values based on the instructor's description of the medical condition to enhance realism. The combined large-group lectures and simulation exercises lasted approximately 4 h.

Research Group

The training in the research group used a combined CBL and PBL with a scenario simulation method. The implementation steps included the following:

1) *Pre-training preparation*: The participants were required to prepare a real self-participated case for PPH rescue, organize the treatment process, and present it in a standardized slide format. The slide followed a unified template including admission information, physical examination, important laboratory tests, induction or delivery information, delivery status, rescue procedures, and follow-up treatment information. The participants also provided personal preliminary responses to three important questions:
    1. What are the high-risk factors and causes associated with bleeding?
    2. Can PPH be prevented?
    3. Are there any measures for improvement?

    Additionally, participants could raise their doubts and propose potential solutions.
2) *Case discussion*: During the discussion session, personnel who prepared cases presented them under instructor guidance. All participants engaged in a comprehensive analysis and discussion of the case, summarizing their findings based on identified problems. A relevant knowledge assessment was then conducted through questionnaires covering topics such as identifying high-risk factors for PPH, preparing high-risk patients before delivery, approximating hemorrhage volume using appropriate methods, and managing PPH. This assessment aimed to identify any knowledge gaps among trainees.
3. *Simulation exercise*: The simulation procedure in the research group was conducted similarly to that in the control group, with instructors selecting representative cases pertaining to various causes of bleeding, such as uterine atony or lacerations. Insights derived from questionnaire

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responses were incorporated into the design of these cases. Each group of 5–6 individuals assumed specific roles according to case requirements, including midwives, nurses, and doctors.

4. *Evaluation and feedback*: After the simulation exercise, group members engaged in a collective discussion regarding any issues encountered throughout the process. Instructors provided guidance and invited experts provided comments and summarizations. The entire process involving discussions and simulation exercises lasted approximately 4 h.

Data Collection

The demographic information of the trainees, including age, professional background, work experience, and maternity institution affiliation level, was collected. A post-training questionnaire survey was conducted among the participants to assess their satisfaction with the training program and measure improvements in trainees' abilities across various domains such as clinical thinking, operant skill, relevant knowledge, team cooperation, and management ability. Additionally, the questionnaire gathered trainees' expectations for future training content.

Statistical Analysis

The statistical analyses were performed using GraphPad Prism 9 (GraphPad Software, San Diego, CA). Continuous variables were presented as mean ± standard deviation, and the two groups were compared using the unpaired t-test. Categorical variables were expressed as frequency and percentage, and the two groups were compared using the chi-square test. $P < 0.05$ was considered statistically significant.

Results

Training Satisfaction

As showed in Table 1, no significant differences were noted between the two groups in terms of age, nurse-doctor ratio, work experience, and maternity institution affiliation levels. However, all trainees in both groups were more familiar with simulation practice than with CBL-PBL training methods. Additionally, the research group showed a significantly higher proportion of participants who provided high satisfaction evaluations than the control group (95.7% vs. 52.8%, $P < 0.01$).

Table 1. Basic situation and satisfaction levels between the two groups.

		Control group n=50	Research group n=26	t value/ χ^2 value	P value
Age		37.8±6.1	37.6±5.6	0.12	0.91
Identity	Obstetricians	32 (68.1)	15 (62.1)	0.29	0.59
	Midwives	18 (31.9)	11 (37.1)		
Years of experience	>10 years	35 (70.0)	15 (57.7)	1.15	0.28
	<10 years	15 (30.0)	11 (42.3)		
Institution level	Tertiary	35 (70.0)	15 (57.7)	1.15	0.28
	Secondary	15 (30.0)	11 (42.3)		
Simulation familiarity	Yes	32 (64.0)	16 (61.5)	0.04	0.83
	No	18 (36.0)	10 (38.5)		

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CBL-PBL familiarity	Yes	5 (10.0)	4 (15.4)	0.48	0.49
	No	45 (90.0)	22 (84.6)		
Satisfaction evaluation	High	28 (52.8)	25 (95.7)	13.07	<0.01
	low	22 (47.2)	1 (4.3)		

Self-Assessment of Enhanced Skills Following the Training Intervention

A questionnaire survey was conducted to assess the enhancement in self-assessment of skills between the two groups. As showed in Table 2, the research group showed significantly higher proportions of improvement than the control group in the following areas: clinical thinking (100% vs. 61.8%, P = 0.03), operant skills related to PPH (100% vs. 57.4%, P < 0.01), relevant knowledge pertaining to PPH (100% vs. 58.7%, P < 0.01), and management abilities (97.1% vs. 39%, P < 0.01).

Table 2. Comparative self-assessment of enhanced skills following the training intervention between the two groups.

	Control group n=50	Research group n=26	χ^2 value	P value
Clinical thinking	42(61.8)	26(100)	4.65	0.03
Operant skill	35(57.4)	26(100)	9.72	<0.01
Relevant knowledge	37(58.7)	26(100)	8.16	<0.01
Team cooperation	44(62.9)	26(100)	3.39	0.07
Management ability	16(39.0)	25(97.1)	28.34	<0.01

Expectations of Trainees for Future Training Content

Through a survey (Table 3), it was found that 98.7% of trainees expressed the expectation for regular simulation training, whereas 93.4% expected regular discussions on PPH cases. These percentages were significantly higher than other forms of training.

Table 3. Expectations of trainees for future training content.

Projects	Number (total number=76)	Proportion
Regular theoretical training	63	82.9%
Regular simulated exercises	75	98.7%
Regular PPH Case Discussions	71	93.4%
The higher-level hospital doctors are requested to conduct a ward round	44	57.9%

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Revisiting a more advanced hospital for additional training	48	63.2%
The PPH cases are reviewed monthly	45	59.2%

Discussion

According to data from the World Health Organization, PPH affects up to 14 million women annually, making it the leading cause of maternal deaths worldwide(Bienstock et al., 2021; Say et al., 2014). While the maternal mortality rate in China has significantly declined over the past three decades, dropping to 15.7 per 100,000 live births in 2022, PPH is still the leading cause of maternal deaths in the country. With the relaxation of family planning policies and an increase in maternal age at delivery, the incidence of PPH has been on the rise, particularly in severe PPH cases, which increased from 0.62% in 2016 to 0.96% in 2020 in China. Therefore, optimizing PPH management is critical for further protection of the lives of pregnant women.

Regular regional training is crucial in managing PPH due to its sudden and unpredictable nature, which places high demands on clinical thinking, technical skills, and team cooperation. Simulation training is one of the most commonly used training methods(Lutgendorf et al., 2017; Parameshwar et al., 2022; Renganathan et al., 2022). Le Lous et al.(Le Lous et al., 2020) conducted a systematic review of several obstetric simulation training studies and found that it has clinical benefits for conditions like umbilical cord prolapse and shoulder dystocia, while also improving teamwork and communication. Kerbage et al.(Kerbage et al., 2016) trained resident physicians in PPH management through simulation training, enabling them to simultaneously gain skills and confidence.

Nevertheless, purely simulated training has limitations in application(Blum et al., 2008; Merién et al., 2010). It often involves scripted scenarios, role-playing, and predetermined language, making it more of a performance than a true simulation of real rescue situations. This can hinder trainees' ability to adapt and think critically. Additionally, technical practice is limited by equipment resources, and some institutions lack complete simulated patients, reducing the effectiveness of simulation. Furthermore, fewer trained participants actually receive recurrent training opportunities(Maslovitz et al., 2007). While training is time-consuming and expensive, there are currently no comprehensive studies on its cost-effectiveness.

PBL and CBL are widely used in clinical teaching and training, particularly in medical student education. PBL transforms the teaching approach from “What I was taught” to “What I want to learn,” enhancing students’ initiative in learning(Dominguez et al., 2018). CBL, on the other hand, analyzes case studies and guides discussions, helping students develop more effective clinical thinking methods(Owen et al., 2007). However, both methods have limitations. PBL requires students to invest time in preparing questions and materials, and without proper guidance, they may lose focus, affecting teaching quality. Similarly, CBL demands extensive preparation from teachers to accumulate enough case studies and design discussion questions, potentially leading to passive student participation and low enthusiasm. Zhao et al.(Zhao et al., 2020) analyzed the advantages and disadvantages of these methods and found better teaching outcomes by combining PBL-CBL methods to train medical students and resident physicians in thyroid nodule management.

As a regional referral center for high-risk pregnant women, our institution is tasked with training healthcare providers from various assisted delivery facilities. Previous training methods predominantly involved traditional lectures or simulation training, with trainees often reporting deficiencies in clinical thinking, operational skills, and team communication. The PBL-CBL training method combines problem-based and case-based discussions. In this study, trainees summarized their experiences in PPH rescue cases and raised questions, which were discussed in groups. This approach helped establish a more rigorous clinical thinking pattern among trainees. Additionally, it saves trainers' time as they can use cases prepared by trainees for subsequent training sessions.

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Moreover, through discussions, trainees become familiar with each other, fostering communication, trust, and better performance in team exercises.

This training method demonstrates good reproducibility and can be widely promoted in all maternity institutions. Its main advantage lies in allowing trainees to review their clinical thinking by preparing their cases, raising questions, and clarifying their understanding through discussion. This process enables them to identify and address knowledge gaps through self-reflection. Subsequently, targeted training via simulation exercises helps improve trainees' clinical thinking, relevant knowledge, and operational skills from multiple perspectives. While simulating resuscitation scenarios with simulated mannequins offers a more realistic experience, the PBL-CBL training method remains effective even in institutions without such equipment, as it can still identify shortcomings in PPH management and provide targeted skills training to enhance overall efficiency.

Nonetheless, this study has some limitations. First, the training method may be more suitable for assistant midwives with clinical experience, as it can be challenging for clinical medical students or lower-level residents to prepare cases and ask questions. Second, despite the PBL-CBL combined simulation training group showing significant improvements in training satisfaction and personal skill enhancement, this study did not evaluate the effect of this training on real clinical practice. Future studies should include relevant evaluation indicators to assess the effectiveness of this training method in actual clinical settings.

In summary, the training of PPH management holds paramount importance for all midwifery practitioners. Simulation-based training serves as a potent tool for experiential learning. The integration of case-based and problem-based learning approaches can facilitate the development of more effective clinical reasoning methods among trainees, while also fostering their proactive attitude towards learning. By combining CBL-PBL with simulation practice, a highly satisfactory outcome can be achieved, significantly enhancing self-assessed skills such as clinical reasoning, procedural proficiency, relevant knowledge acquisition, teamwork collaboration, and managerial competence among midwifery trainees.

Conclusion

In conclusion, PPH, as the leading cause of maternal mortality worldwide, requires significant attention from midwifery professionals. Regular training in PPH rescue techniques is essential for preventing severe complications. The combination of CBL-PBL teaching methodology with simulation practice has shown to be highly effective, significantly enhancing self-assessment of skills among midwifery trainees. Further studies should explore the incorporation of regular training on PPH rescue skills and evaluate their effectiveness in real clinical settings to ensure that midwifery professionals are well-prepared to manage PPH and reduce maternal mortality rates.

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Abbreviation

PPH: Postpartum Hemorrhage; CBL: case-based learning; PBL: problem-based learning

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