Original Article

The Effects of Competency-Based Education on Midwifery Students' Knowledge, Skills, and Self-Confidence for Postpartum Hemorrhage Management

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ABSTRACT

Background: Hemorrhage is a leading cause of maternal death in the perinatal period. New teaching methods have been recommended for promoting midwives' competence in maternal care delivery. **Objectives:** This study was conducted to determine the effects of a competency-based education (CBE) program on midwifery students' knowledge, skills, and self-confidence for postpartum hemorrhage (PPH) management. **Methods:** This experimental study was conducted in 2018 on 86 third-, fourth-, and fifth-semester midwifery students recruited from the Faculty of Nursing and Midwifery of Iran University of Medical Sciences, Tehran, Iran. They were randomly allocated to either a control ($n = 43$) or an intervention group ($n = 43$). Participants in the control group received routine formal midwifery education, while their counterparts in the intervention group received CBE in addition to routine formal midwifery education. Participants' knowledge, skills, and self-confidence for PPH management were assessed at three time points, namely before, immediately after, and six weeks after the study intervention. Data were analyzed through performing the Chi-square and the independent-samples t-tests and the repeated measures analysis of variance. **Results:** There were no significant differences between the intervention and the control groups regarding the pretest mean scores of knowledge (4.87 ± 1.58 vs. 5.05 ± 2.07), skills (80.12 ± 5.72 vs. 82.30 ± 6.89), and self-confidence (7.05 ± 1.19 vs. 6.62 ± 1.47) ($P > 0.05$). In the intervention group, the mean scores of knowledge, skills, and self-confidence were significantly greater than the control group both at the first posttest (10.17 ± 1.31 vs. 5.20 ± 1.55, 301.15 ± 19.30 vs. 80.50 ± 5.12, and 9.47 ± 1.19 vs. 6.80 ± 0.91, respectively) and the second posttest (9.37 ± 2.21 vs. 5.32 ± 1.50, 299.67 ± 17.58 vs. 81.07 ± 5.69, and 9.72 ± 1.28 vs. 6.52 ± 1.44, respectively) ($P < 0.05$). **Conclusion:** CBE is effective in significantly improving midwifery students' knowledge, skills, and self-confidence for PPH management, and hence, it is recommended for promoting their competence.

KEYWORDS: *Clinical skills, Competency-based education, Midwifery, Postpartum hemorrhage, Self-confidence, Student*

INTRODUCTION

Reports show that 289000 women still die annually in the perinatal period worldwide.[1] Around 99% of all maternal deaths happen in developing countries such as Afghanistan.[2] In 2017, maternal mortality rate (MMR) in Afghanistan was 638 per 100,000 live births, while this rate in Iran, a neighboring country of Afghanistan,

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is as low as 16 per 100,000 live births.[3] The leading causes of MMR in Afghanistan are hemorrhage (56%) and eclampsia and obstructed labor (31%).[4]

The World Health Organization recommended specific strategies to reduce MMR. One of these strategies is to promote the quality of maternal care services through improving midwives' knowledge, skills, and competence and employing qualified and competent midwives.[5,6] Midwives play a significant role in maternal care delivery. Some evidence suggests that qualified midwives provide 87% of all health-care services needed for women and their children,[7] and hence, 82% cases of MMR can be prevented through quality midwifery care.[8] Nonetheless, studies show that midwives and other health-care providers have limited skills, competence, and self-confidence for quality maternal care delivery, particularly in the area of managing postpartum hemorrhage (PPH),[9] which is a leading cause of maternal death.[4] Some reports show that new graduates in medical sciences are not competent enough and have limited professional skills to work in hospitals.[10]

Theory–practice gap is one of the main causes of health-care providers' limited professional competence.[11,12] Some evidence shows that the quality of midwifery education is low. The primary findings of a survey by the World Health Organization revealed that there were weaknesses in midwifery education.[9] A study in Ethiopia also showed the need for improving the quality of midwifery education in order to promote midwives' competence in care delivery.[13] Therefore, improving the quality of midwifery education and services can significantly improve health-related outcomes among women and reduce MMR.[8]

A potentially effective strategy to improve the quality of midwifery education is to shift from teacher-centered teaching to student-centered teaching. One of the student-centered teaching methods is competency-based education (CBE).[14] Although some studies assessed the effects of CBE among nursing students, there is limited information about its effects on midwifery students.[15]

Objectives

This study was conducted to determine the effects of a CBE program on midwifery students' knowledge, skills, and self-confidence for PPH management.

METHODS

Study design and participants

This experimental study was conducted in 2018 with a two-group design. Participants were 86 third-, fourth-, and fifth-semester undergraduate midwifery students recruited from the Faculty of Nursing and Midwifery of Iran University of Medical Sciences, Tehran, Iran. The only inclusion criterion was no clinical work experience other than internship course, to ensure that the only source of participants' PPH-related information was the official midwifery curriculum. Participants were excluded if they had any absence from the sessions of the study intervention or voluntarily withdrew from the study.

Sample size was calculated with a confidence level of 0.99, a power of 0.90, and a mean and standard deviation of satisfaction of 71.19 ± 8.60 in one group and 59.65 ± 11.63 in the other group.[16] Sample size calculation formula [Figure 1] showed that at least 24 participants per group were needed. However, we recruited all the available students with inclusion criteria and then randomly allocated 43 students to either a control or an intervention group using random numbers in sealed envelopes. Random allocation was performed by one of the researchers who was blind to the allocation sequence.

Data collection instruments

Instruments were a demographic questionnaire, a PPH-related knowledge questionnaire, a clinical competence assessment checklist, and a self-report self-confidence questionnaire. The demographic questionnaire had items on students' age, last-semester grade point average, experience of managing normal delivery, and experience of managing PPH, episiotomy, and hypovolemic shock.

The PPH-related knowledge questionnaire had 12 multiple-choice questions about students' knowledge in PPH diagnosis and management. Each question had a correct answer and three incorrect answers which were, respectively, scored 1 and zero, resulting in a possible total score of 0–12. Higher scores showed greater PPH-related knowledge.

The clinical competence assessment checklist included four main parts, namely episiotomy and its repair (20 items), manual removal of the placenta (17 items), bimanual uterine compression (9 items), and hypovolemic shock management (8 items). The checklist had been developed based on the Emergency Obstetric and Newborn Care course of Columbia University and

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta} \right)^2 \left(\sigma_1^2 + \sigma_2^2 \right)}{\left(\mu_1 - \mu_2 \right)^2}$$

Figure 1: Sample size calculation formula

existing standardized instruments on birth-related clinical competence tested at the Reproductive Health Access, Information, and Services in Emergencies training center in Nairobi.[17] As the checklist was in English, two independent translators translated it into Persian through the forward–backward translation method. Items were scored on a five-point scale from 1 ("completely unsatisfactory") to 5 ("completely satisfactory"). Accurate performance of 90% of the items of each part was interpreted as competence in the corresponding skill.[18]

Performance evaluation was performed by four assessors in four main stations using the Objective Structured Clinical Examination (OSCE). OSCE is a valid and reliable method for clinical skill evaluation and clinical skill improvement.[15,19] All four assessors held master's degree in midwifery and had received 5-h training from the first author of the study about how to accurately perform each of the four skills and how to use the checklist for performance evaluation. For assessing the inter-rater reliability of assessors, two midwifery instructors simultaneously and independently rated their performance. Inter-rater kappa coefficients for all four assessors were >0.7.

The fourth instrument of the study was a self-report self-confidence questionnaire. Its items were scored on a three-point Likert scale from 1 ("no self-confidence") to 3 ("great self-confidence"). This questionnaire was adopted from an emergency obstetric care package published by the Guidelines for Assessment of Skilled Providers after Training in Maternal and Newborn Healthcare proposed by Johns Hopkins Program for International Education in Gynecology and Obstetrics.[18] This questionnaire was translated into Persian through the forward–backward translation method.

The face and content validity of the PPH-related knowledge questionnaire, the clinical competence assessment checklist, and the self-report self-confidence questionnaire were assessed by 6–11 midwifery experts. Ten questions of the primary knowledge questionnaire were excluded during face validity assessment. Moreover, eight questions of the primary knowledge questionnaire and eight items of the primary clinical competence assessment checklist were excluded during content validity assessment. The content validity indices of the final knowledge questionnaire, clinical competence assessment checklist, and self-report self-confidence questionnaire were 0.91, 0.95, and 0.97, respectively. The test–retest stability method was also used for reliability assessment. Accordingly, twenty midwifery students completed the instruments twice with a 2-week interval. The test–retest correlation coefficients of the

three instruments were 0.91, 0.79, and 0.89, respectively. The twenty students who completed the instruments for reliability assessment were not included in the study.

Intervention

The study intervention was a CBE program implemented through theoretical and practical training sessions. Theoretical training sessions were held in classroom using lectures, PowerPoint presentations, and video presentation, while practical training sessions were held in a practical skills laboratory using the simulation method. Trainings were provided in four 5-h weekly sessions in a whole month. For practical training, students in the intervention group were divided into eight 5–6-student groups. In practical training sessions, the first author primarily performed each skill and provided participants with necessary explanations and then provided them with the opportunity to discuss the skill and practice it one by one. She supervised participants' skill performance and provided them with feedback in order to correct their errors. Each participant practiced each skill for several times up to gaining competence in its performance. The content of the CBE program was developed using midwifery textbooks, the Emergency Obstetric Care package of Columbia University,[17] and the Emergency Obstetric Care package of the Averting Maternal Death and Disability program.[20] Participants' knowledge, skills, and self-confidence for PPH management were assessed in both groups at three time points, namely before, immediately after, and 6 weeks after the study intervention.

Ethical considerations

This study was approved by the Ethics Committee of Iran University of Medical Sciences, Tehran, Iran (code: IR.IUMS.REC.1397.026), and was registered in the Iranian Registry of Clinical Trials (code: IRCT20180609040017N1). Necessary permissions for doing the study were obtained from the authorities of the study setting. All participants received clear explanations about the study aim, study methods, and data confidentiality and their informed consents were obtained.

Data analysis

Data were analyzed using the SPSS program v. 16.0 (SPSS Inc., Chicago, IL, USA). Normality was checked through the Kolmogorov–Smirnov test, and data were described using descriptive statistic measures such as frequency, mean, and standard deviation. The Chi-square and the independent-samples t-tests were performed for between-group comparisons regarding participants' characteristics. Moreover, the repeated measures analysis of variance and the independent-samples t-test were performed for

within- and between-group comparisons regarding the mean scores of participants' knowledge, skills, and self-confidence for PPH management.

RESULTS

Primarily, 86 students were recruited to the study. Three participants from the control group were unable to attend the second posttest due to having another examination and three students from the intervention group were unable to attend the second posttest or did not regularly attend the intervention sessions due to attendance at their clinical courses [Figure 2].

There were no significant differences between the groups regarding participants' age, place of residence, last-semester grade point average, experience of managing normal delivery, and experience of managing PPH, episiotomy, and hypovolemic shock. Table 1 shows participants' characteristics.

The repeated measures analysis of variance was used for within- and between-group comparisons regarding the mean scores of participants' knowledge, skills, and self-confidence for PPH management across the three measurement time points. The result of the Mauchly's test of sphericity for the PPH-related skills variable was significant ($P < 0.001$), indicating that the assumption of symmetry was not met. Therefore, the results of Greenhouse–Geisser correction method were reported.

However, the results of the Mauchly's test of sphericity for the PPH-related knowledge and self-confidence were not significant, implying that the assumption of symmetry was met. The results of repeated measure analysis of variance showed that the variations of the mean scores of participants' knowledge, skills, and self-confidence for PPH management were significant across the three measurement time points ($P < 0.001$). The effects of group and time-group interaction were also significant for all three variables ($P < 0.001$). In the intervention group, the mean scores of knowledge, skills, and self-confidence for PPH management at the first posttest were significantly greater than their corresponding pretest values ($P < 0.05$) and did not significantly differ from their corresponding values at the second posttest [$P > 0.05$; Table 2]. In the control group, the mean scores of knowledge, skills, and self-confidence for PPH management did not significantly change across the three measurement time points ($P > 0.05$). Figures 3-5 show the trends of the variations of the mean scores of knowledge, skills, and self-confidence for PPH management in the control and the intervention groups across the three measurement time points.

The results of the independent-samples t-test showed that the between-group differences regarding the pretest mean scores of knowledge, skills, and self-confidence for PPH management were not statistically significant ($P > 0.05$).
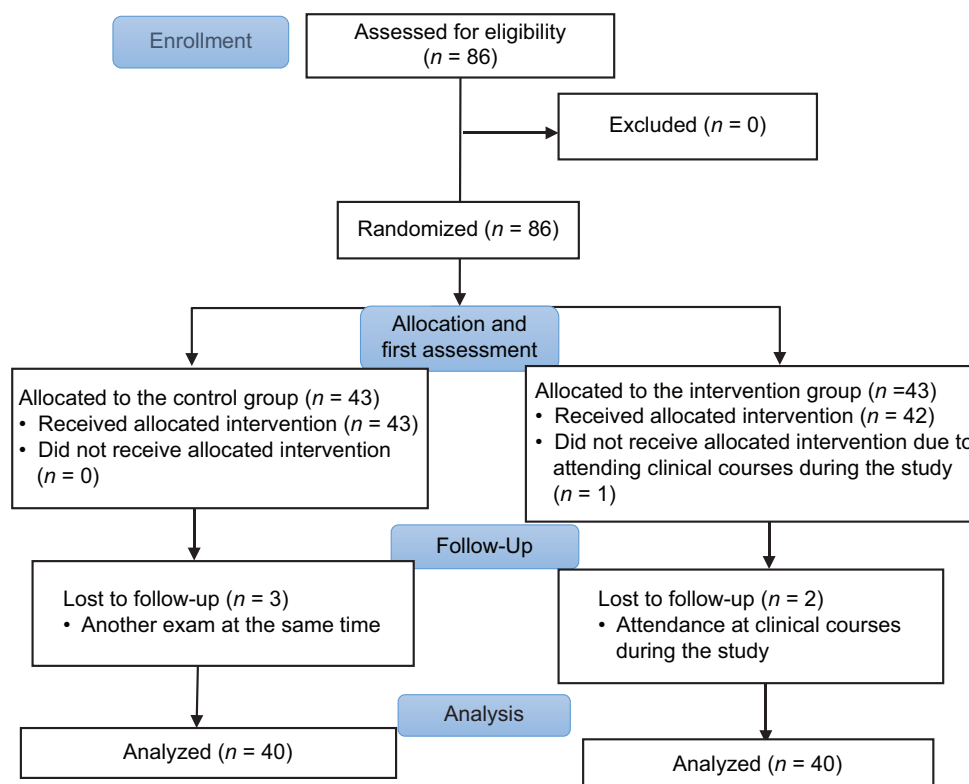

Figure 2: The flow diagram of the study

Table 1: Between-group comparisons regarding participants' characteristics

Characteristics	Groups		P
	Intervention, *n* (%)	Control, *n* (%)	
Age (mean±SD)	21.60±2.38	22.27±3.00	0.269[a]
Grade point average (mean±SD)	16.64±0.97	16.47±0.98	0.442[a]
Place of residence			
Governmental dormitory	16 (40.0)	11 (27.5)	0.434[b]
Private dormitory	11 (27.5)	14 (35.0)	
With parents	13 (32.5)	15 (37.5)	
Experience of normal delivery management			
Yes	29 (72.5)	32 (80.0)	0.430[b]
No	11 (27.5)	8 (20.0)	
Experience of PPH management			
Yes	4 (10.0)	5 (12.5)	0.99[b]
No	36 (90.0)	35 (87.5)	

[a]The results of the independent-samples *t*-test, [b]The results of the Chi-square test. SD: Standard deviation, PPH: Postpartum hemorrhage

Table 2: Within- and between-group comparisons regarding the mean scores of knowledge, skills, and self-confidence for postpartum hemorrhage management

Variables/Group	Time			P[a]		
	Before	Immediately after	Six weeks after	Time	Time × Group	Group
Knowledge						
Intervention	5.05±2.07	10.17±1.31	9.37±2.21	<0.001	<0.001	<0.001
Control	4.87±1.58	5.20±1.55	5.32±1.50			
P[b]	0.673	<0.001	<0.001			
Skills						
Intervention	82.30±6.89	301.15±19.30	299.67±17.58	<0.001	<0.001	<0.001
Control	80.12±5.72	80.50±5.12	81.07±5.69			
P[b]	0.129	<0.001	<0.001			
Self-confidence						
Intervention	6.62±1.47	9.47±1.19	9.72±1.28	<0.001	<0.001	<0.001
Control	7.05±1.19	6.80±0.91	6.52±1.44			
P[b]	0.162	<0.001	<0.001			

[a]The results of the repeated measures analysis of variance, [b]The results of the independent-samples *t*-test

However, the mean scores of knowledge, skills, and self-confidence for PPH management in the intervention group were significantly greater than the control group at both posttests [$P < 0.05$; Table 2].

DISCUSSION

Findings showed that although 75% of participants had received educations about PPH management during their formal university education, they lacked competence for effective PPH management at baseline. In line with this finding, a former study on 27 sixth-semester midwifery students revealed that the level of their clinical competence was <50%.[11] Another study on 35 midwifery students reported that although they had adequate knowledge about maternal deteriorations, the quality of their performance decreased with increasing deterioration in maternal conditions.[21]

Study findings showed that the CBE program significantly increased midwifery students' knowledge and skills for PPH management. A former study reported that through linking theory and practice, CBE promoted learning and helped students have sufficient flexibility during their learning and practice.[22] Another study highlighted that CBE enabled students to integrate their knowledge with their skills, effectively perform their tasks, and positively affect workplace.[23]

Our findings also indicated that the CBE program significantly improved midwifery students' self-confidence in PPH management. Consistent with our findings, a former study reported that practicing skills in the skills laboratory significantly improved students' self-confidence.[24] Another study reported that skill training in skills laboratory using the simulation method can be effective in improving students' skills, self-confidence, and practice.[25] A systematic review also revealed that new teaching methods such as simulation and CBE enhanced students' knowledge, competence, teamwork, and communication skills and
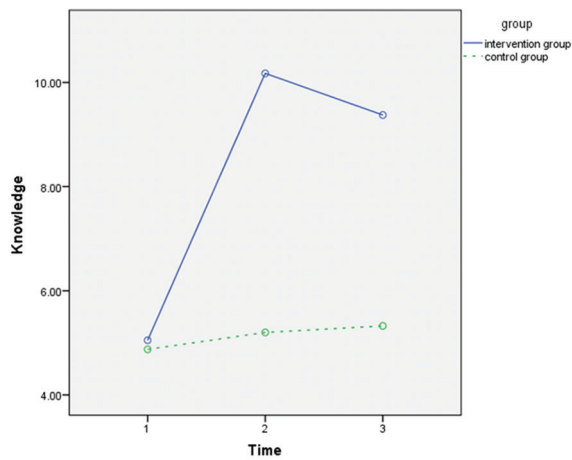
Figure 3: The trends of the variations of the mean score of knowledge in the control and the intervention groups across the three measurement time points
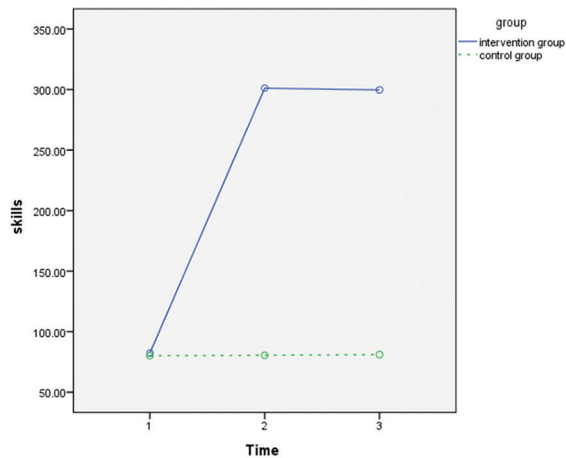

Figure 4: The trends of the variations of the mean score of skills in the control and the intervention groups across the three measurement time points
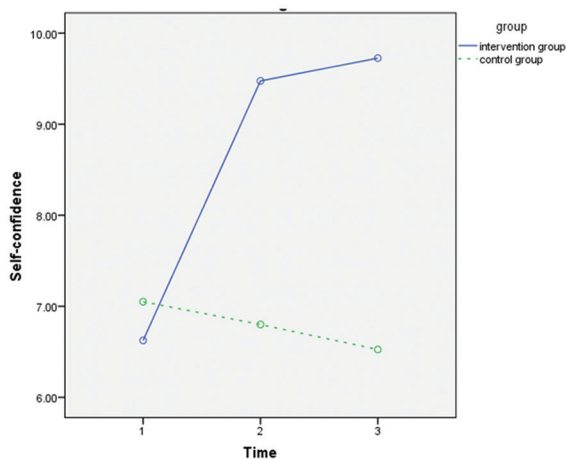

Figure 5: The trends of the variations of the mean score of self-confidence in the control and the intervention groups across the three measurement time points

reduced their stress.[26] Similarly, another study found simulation effective in significantly improving the

necessary skills for PPH management.[27] Our findings was also consistent with the findings of a randomized controlled trial which reported that simulation significantly improved nursing students' knowledge and skills for PPH management.[28] However, a randomized controlled trial showed the ineffectiveness of a 1-day simulation-based team training program in significantly reducing obstetric complications and recommended follow-up training sessions for skill retention.[29] The contradiction between the findings of this study and our findings is attributable to the differences in the interventions and the participants of the studies.

One of the possible explanations for the improvement of midwifery students' knowledge, skills, and self-confidence for PPH management in the present study is the use of OSCE for skill assessment as well as CBE. As a very useful objective method for performance evaluation,[28,30] OSCE can more significantly increases the depth of learning compared with other performance evaluation methods and is associated with many different positive learning outcomes.[31] OSCE also helps provide learners with supportive feedback which in turn enhances the effects of educational interventions.[15]

In order to prevent between-group information leakage, we first completed the study for all participants in the control group and then implemented the study intervention for participants in the intervention group. The questions of the knowledge questionnaire had also been formulated as case studies, and hence, students with rote learning were unable to easily answer them. A main limitation of the study was the fact that the first author who implemented the study intervention was the facilitator of the four-assessor skill assessment team.

CONCLUSION

This study suggests that CBE significantly improves midwifery students' knowledge, skills, and self-confidence for PPH management. CBE has the potential for improving the quality and the effectiveness of midwifery education and thereby, improving the quality of midwifery care services. Through promoting midwives' knowledge, skills, and self-confidence, it can also reduce the risk of their clinical errors, reduce their occupational stress, and improve maternal health outcomes. Therefore, midwifery managers and authorities are recommended to use CBE in midwifery education and develop competency-based curriculum for midwifery students. Future studies are recommended to assess the effects of CBE and OSCE on different clinical skills among health-care students and providers as well as on different health-related outcomes among clients.

Acknowledgment

Conflicts of interest

There are no conflicts of interest.

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