

Investigating the effect of neonatal resuscitation simulation using a competency-based approach on knowledge, skill, and self-confidence of midwifery students using objective structured clinical examination (OSCE)

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ABSTRACT

Background: First-day neonate death has the highest rate in infant mortality. Using modern educational methods such as simulation and competency can be effective in improving learners' performance and subsequently their confidence. **Material and Method:** This study was a quasi-experimental intervention on 80 midwifery students of semester 3, 4, and 5 undergraduate degrees. Eighty-six students registered after the researcher's explanations. The learners were randomly assigned into two groups while they were receiving routine midwifery education according to the midwifery curriculum. The learners in the intervention group (in seven groups) received a 7-hour session about neonate resuscitation. The theory session was conducted using PowerPoint presentation, lecture, video, and pictures. The practical session was conducted using simulation with manikins of skill laboratory. The skill practice continued until the learners achieved competency (performing 90% of resuscitation steps). The learners were assessed before, immediately, and 6 weeks after training using questionnaires and a checklist. The data were analyzed using SPSS, descriptive, and inferential statistics. **Results:** The knowledge, skill, and self-confidence scores increased significantly immediately after the training ($P < 0.001$), from 5.05 ± 2.07 (out of 12) to 10.17 ± 1.31 , 18.90 ± 3.14 to 68.45 ± 2.05 , and 1.50 ± 0.55 to 2.02 ± 0.57 , respectively. The changes were retained 6 weeks after the training. These changes were not observed in the control group. **Conclusion:** Competency-based, simulation-based, and objective structured clinical examination (OSCE) were effective in students learning to manage initial neonatal resuscitation in the skills' lab, and this increase was retained 6 weeks after the training.

Keywords: Competency-based education, midwifery, neonatal resuscitation, objective structured clinical examination, self-confidence, skill, student

Introduction

More than 2.5 million babies died in their first month of birth in 2017, and 38 percent of neonatal mortality occurs in the first month of life. The effective factors in this mortality are the low

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How to cite this article: Hakimi M, Kheirkhah M, Abolghasemi J, Hakimi R. Investigating the effect of neonatal resuscitation simulation using a competency-based approach on knowledge, skill, and self-confidence of midwifery students using objective structured clinical examination (OSCE). *J Family Med Prim Care* 2021;10:1766-72.

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Received: 10-04-2020

Revised: 27-04-2020

Accepted: 03-11-2020

Published: 29-04-2021

Access this article online

Quick Response Code:



Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_592_20

quality of care and treatments in the first days of life.^[1] In 2017, in Afghanistan and Iran, the neonatal mortality rate (NMR) was 29.7 to 49.9 and 5.4 to 15 neonate deaths per 1000 live births, respectively. Afghanistan has the highest neonatal mortality rate in the world after African countries and Pakistan.^[2] One of the main causes of neonate mortality (NM) on the first day and immediately after birth is asphyxia or inability to breathe which is responsible for neonatal death in 23 percent of cases.^[3,4] The key treatment for this disorder is neonatal resuscitation (NR); the WHO documents show that health care providers could not perform this crucial skill properly, and this lack is due to improper training^[5] Also, it seems that the quality of midwifery education needs to be upgraded, and midwifery students do not have sufficient competence to perform some midwifery skills such as skills related to obstetric emergencies immediately after graduation^[6] (Aisling A. Garvey). NR is a skill that is needed to be anticipated for each delivery and birth and all mothers in labor.^[4]

Training in NR, even with a simplified version, can be effective in reducing neonatal mortality.^[7,8] Training in positive pressure ventilation and neonatal resuscitation can be effective using competency-based educational approaches before graduation or during in-service. This approach concentrates on developing competence, good performance, and mastery in specific skills.^[9,10] Simulation-based learning through learning aids can play an important role in education and development (Naod Bulti Etanaa Simran K Ghoman). Also, using simulation in skill training and valid/objective method of evaluation plays an important role in competency achievement in such skills. Objective assessment is effective in reducing the gap between theory and clinical practice and increasing the focus on the practical consequences of skill learning.^[11] NR training in routine approach and without special modern approach such as competency-based has reduced neonatal mortality during the first 28 days of life; however, using new and innovative approaches have been suggested to improve the retention of learners' knowledge, skills, and behavior.^[7,12] The purpose of this study was to evaluate the effect of NR simulation using the competency-based approach on knowledge, skill, and confidence of midwifery students in an objective structured clinical examination (OSCE).

Material and Method

Study participants

The midwifery students in semester 3, 4, and 5 were informed about the training by posters and presentations in their classrooms. They were registered using a convenient method and randomly assigned into two groups (A = intervention and B = control) using a stratified systematic sampling method. All students in both groups were receiving routine midwifery programs according to the midwifery curriculum, Iran University of Medical Sciences that is similar in all medical universities in Iran. The participants in group A received another training on neonatal resuscitation using a competency-based approach and objective structured clinical examination (OSCE). The training was designed in a 7-h session about neonate resuscitation. This session consisted of 2-hour theory teaching using PowerPoint presentations, video, and pictures

and a 5-hour practical session using simulation by the researcher using manikins of neonate resuscitation, bag, mask, suction, and other related materials; the learners practiced under the researcher supervision. This practice continued until they were able to do this skill competently (performing 90% of skill steps).^[13] The approval from the ethics committee is obtained in 24/06/2018.

Description of outcome measures

The study outcomes were measured using four questionnaires and a checklist that included demographic, knowledge, and self-confidence questionnaires and neonatal resuscitation checklist. The knowledge questionnaire was designed in 30 multiple choice questions (MCQs) case-study by the research team. The face validity of that was determined by six midwifery faculty members, and it resulted in removing 10 questions. To check its content validity, it was determined by 11 midwifery experts and faculty members using content validity index (CVI) and content validity ratio (CVR) scores. As a result, eight questions were removed and for the other questions, the CVI score was 0.91. Each question had one correct and three incorrect answers. Each correct answer scored 1, and the overall score was 12. Providing correct answers to 80% of the questions was considered as competency in the knowledge dimension.^[13]

The students' skill was assessed using neonatal resuscitation checklist, OSCE design, and a neonatal resuscitation scenario. The checklist was arranged based on Emergency Obstetric Care (EmOC)¹ package published by Colombia University. It was forward and backward translated by two different translators. To validate it, face and content validity were checked and confirmed. The process was similar to the process for the knowledge questionnaire. In the process of content validity, the second step of the original checklist was removed. The CVR score was 0.95. The checklist had 14 steps, and each step was scored on a 5-point Likert scale, from 1 (completely unsatisfactory) to 5 (completely satisfactory). The scope of the score was from 14 to 70, and 63 was the cut-off point.

The self-confidence questionnaire was a self-reported questionnaire adapted from "Guidelines for Assessment of Skilled Providers after Training in Maternal and Newborn Healthcare" published by Johns Hopkins University. It was prepared, translated, and validated similar to the checklist. The CVI score was 0.97. It was answered on a 3-point Likert scale using "1 = no self-confidence to 3 = fully self-confident".

To check the reliability of all questionnaires and checklists, the "test-retest" method was applied. All questionnaires were completed by 20 midwifery students twice with a 2-week interval. The checklist was completed by the researcher twice at a 2-week interval while students were performing neonatal resuscitation. These students were not a part of the study sample. The correlation coefficient was 0.91 in the knowledge section, 0.79 in the skill section, and 0.89 in the self-confidence section.

1 Emergency Obstetric Care

Trial design

A randomized controlled design was followed. In this design, there were two post-tests with 6 weeks intervals to investigate the retention of knowledge, skill, and self-confidence. Group B assessments were arranged before the training to prevent information bias. The students signed an informed consent, and all information about data anonymity and confidentiality was explained.

On the first day of the study, all the participants completed the demographic, knowledge, and self-confidence questionnaires and participated in the skills assessment using the OSCE method. Group A received training about neonatal resuscitation using competency-based simulation and OSCE. Educational content was prepared based on the midwifery reference books such as “Myles textbook for midwives,” “Williams Obstetrics,” and the EmOC training package of the California University. The theory session was implemented using PowerPoint presentations and instructional videos. The simulation was performed in the skills laboratory by the first author using manikins. The learners practiced and performed the skill using the neonate resuscitation checklist in small groups (n = 6). The skill practice continued until each learner gained competence under the direct supervision of the research team with appropriate feedback to perform the skill correctly. The practical session was from 3 to 5 h for each group. The evaluation of knowledge, skill, and confidence was performed immediately after the end of the training and 6 weeks later to evaluate the retention of information.

Analysis

The data were analyzed using SPSS (v. 16), descriptive statistics (frequency tables, mean (± standard deviation), and inferential statistics (Chi-square, independent t-test, and repeated measures ANOVA). The level of significance was $P < 0.05$.

Results

Out of 86 students registered to participate in the study, 80 completed the trial. Three students in group A could not continue the training as their routine hospital training overlapped with the study timetable. Three students in group B were excluded from the analysis as they could not

participate in follow-up assessment because they had other exams. Therefore, the final analysis was performed on 80 participants (A = 40 students and B = 40 students). Using the Kolmogorov-Smirnov test, the normality of the quantitative data was confirmed ($P \geq 0.05$).

There was no statistically significant difference between the groups with respect to age, place of residence, grade point average (GPA) of the last semester, and the number of resuscitation management or observation. The learners’ demographic characteristics are reported in Table 1.

The mean knowledge, skill, and self-confidence scores in group A increased significantly immediately and 6 weeks after the training compared to the scores of the pretest ($P < 0.001$). Repeated measures test showed that there was no statistically significant difference between the scores of knowledge, skill, and self-confidence between first and second post-tests with 6 weeks interval that showed knowledge, skill, and self-confidence retention ($P = 0.056$, $P = 0.160$, and $P = 0.097$, respectively) [Table 2]. The charts 1, 2, and 3 show the trend of changes in knowledge, skill, and learners’ confidence in both groups.

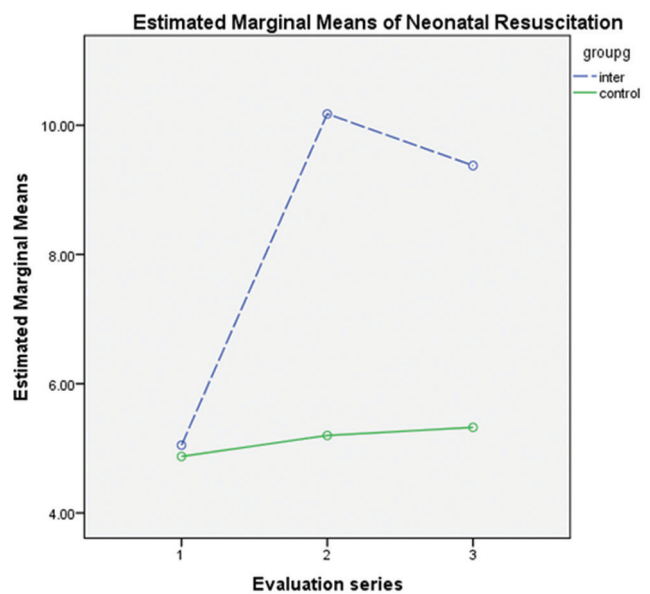


Chart 1: The comparison of knowledge in groups A and B

Table 1: Demographic characteristics of participants

Variable	Group A (mean±S.D)	Group B (mean±S.D)	Statistics
Age	21.60 (±2.38)	22.27 (± 3.00)	$t=1.11; P=0.269$
Past term GPA	16.64 (±0.97)	16.47 (± 0.98)	$t=0.73; P=0.442$
Residence Place			
Governmental dorm	16	11	$df=2, \chi^2=2.735, P=0.434$
Non-Governmental dorm	11	14	
Living with parents	13	15	
Experience in neonatal resuscitation			
Yes	1	2	$df=1, FET1 P=1.00$
No	39	38	

Table 2: Main outcomes in both groups

Variables	Evaluation Time	Groups Mean (S.D)		Confidence Interval		P
		A	B	Lower bound	Upper bound	
Knowledge	pretest	5.05 (2.07)	4.87 (1.58)	4.29	5.63	0.673
	Posttest 1	10.17 (1.31)	5.20 (1.55)	4.74	10.62	<0.001
	Posttest 2	9.37 (2.21)	5.32 (1.50)	4.72	9.97	<0.001
P						<0.001
Skills	pretest	18.90 (3.14)	18.30 (3.05)	17.32	19.87	0.390
	Posttest 1	68.45 (2.05)	18.15 (2.73)	17.39	69.21	<0.001
	Posttest 2	68.35 (2.19)	18.77 (4.22)	17.71	69.41	<0.001
P						<0.001
Self-Confidence	pretest	1.50 (0.55)	1.52 (0.50)	1.33	1.69	0.834
	Posttest 1	2.30 (0.46)	1.37 (0.49)	2.15	2.45	<0.001
	Posttest 2	2.02 (0.57)	1.40 (0.49)	1.23	2.19	<0.001
P						<0.001

Discussion

The results of the assessments following the intervention demonstrated a significant increase in knowledge, skill, and self-confidence to manage initial NR in the skill laboratory center, after a 5-h training using a competency-based approach and OSCE. In such a critically urgent situation, knowledge, skill, and self-confidence maintenance on NR seem to be a necessary aspect to manage it expertly. The relative rarity of NR, particularly, during educational years may result in no NR encounters and make it an uneasy skill for newly graduates.^[14] Although all the participants had studied neonatal resuscitation before our training according to the midwifery curriculum in the faculty of nursing and midwifery, most of the students reported: “no self-confidence” in the self-reported self-confidence questionnaire. Also, half of the students were at the end of semester 4 (associate degree) and were supposed to be competent in this skill. The results of Lee *et al.*^[15] showed that more than 75% of learners (emergency medicine residents) did not have the confidence to lead an NR at all.^[15] Our result was consistent with another study by Ross *et al.*^[16] The study by Nickerson *et al.* also showed that the confidence of emergency medicine (EM) residents can be improved using the simulation method of teaching. The majority of learners (80%) reported increased confidence 1 year after training (Nickerson *et al.*, 2019).

In the skill dimension that was assessed using OSCE in the skills lab center, the learners could not achieve the expected scores (performing 90 percent of steps). This result was consistent with the results of a study by Cusack that was conducted on pediatric trainees. Forty-nine and 44 percent of junior and senior trainees could not perform resuscitation according to the resuscitation algorithm although this topic was taught before.^[17] These significant numbers of trainees that failed in OSCE in NR skills may illustrate the gap in our practical education. Also, it is clear that students need an environment to practice skills without any stress of hurting the patient.^[18]

In group A, the learners’ self-confidence increased immediately after the end of the training as well as their knowledge and skill.

In the knowledge dimension, the present study results were consistent with Singhal *et al.* that showed 54% of the participants passed knowledge test using MCQs with a score of 80 or higher, but mastery in resuscitation skill had not been achieved in the classroom setting.^[19] The results of another study by De Bernardo *et al.* were not consistent with our study. In that study, simulation-based had a limited impact on the skills of participants. This study in skill dimension was not consistent with our study. There were other studies consistent with this low knowledge and skill.^[5,20] In competency-based education (CBE), practicing one skill several times until the learner would be able to perform the skill competently seems to be the main factor in achieving competency and retention. In this study, all the participants had achieved competency in neonatal resuscitation while no one was competent (perform 90% steps of skill) before the training.

The results of the studies by Kc *et al.*^[21] Arlington *et al.*^[22] and Etanaa *et al.*^[23] were consistent with our study. The knowledge and skill had increased significantly in these studies. However, the study by Bang *et al.*^[24] was not consistent with this study. Knowledge and skill of birth attendants increased by more than 90 percent immediately after the training. However, the percentage of learners who completed OSCE successfully declined to almost 80. In this study, the researcher used helping babies breathe (HBB)² training following refresher training. New teaching strategies such as CBE can enhance students’ learning and creativity; therefore, it brings the learning process on sound bases for life-long learning. In addition, this method can simulate the self-confidence feeling to the learners.^[25] Also, these approaches can increase skill retention by the emphasis on understanding the concepts of learning, skill-building, and activity-based learning/learning labs.^[26] The results of the study by Gruszka *et al.* (2019) consistent with this study revealed that there are some deficiencies in the midwives’ knowledge both practically and theoretically to provide perinatal care (Gruszka *et al.*, 2019).

Although NR is one of the main responsibilities of neonatologists and obstetricians in Iran, provision of care for

2 Helping Babies Breath

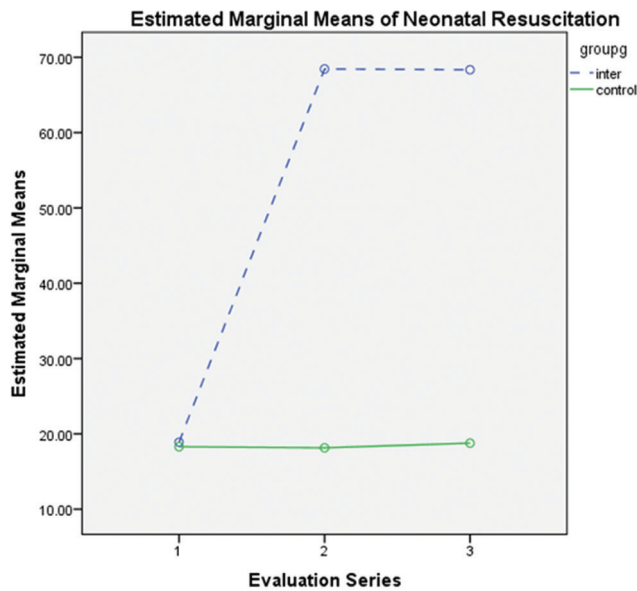


Chart 2: The comparison of skill in groups A and B

newborn and infant is one of the midwives’ duties according to the midwives competencies announced by the International Federation of midwives (ICM) and they should be competent in it,^[27] and midwives are most likely to initiate first steps of NRs than other health professionals.^[28] That high rate of no competent midwifery students can show the gap in midwifery education. The main aim of this study was to reduce the gap between theoretical and clinical education in midwifery, and it seems that the gap is stable despite all training and workshops (13). Bridging this gap is possible if students practice what they are learning, and it is more likely to keep the knowledge after the training compared to the ones sitting in the classroom.^[29]

In this study, the main emphasis was on the competency-based approach. It was to ensure competency achievement in NR in the skills laboratory. Also, to validate the assessment, OSCE was applied using a pre-prepared checklist and scenario. The results of this study revealed that the competency-based approach and OSCE can increase and retain learners’ knowledge, skill, and confidence in neonatal resuscitation until 6 weeks. In the competency-based approach, the concept of competency is related to the activity area and reflects a collection of knowledge and skills to perform a task independently. Self-confidence is one of the factors that show professional competence.^[30]

As the prevalence of neonatal mortality and morbidity is high throughout the world and some of the causes are preventable (2), also, to reduce costs of conducting in-service training (14), this study was designed and implemented on students before graduation and internship. This period seems to be the best time because students have learned normal birth, and they are ready to work under supervision at hospitals. In other words, every situation and case while they are practicing can maintain what they had learned in the training.

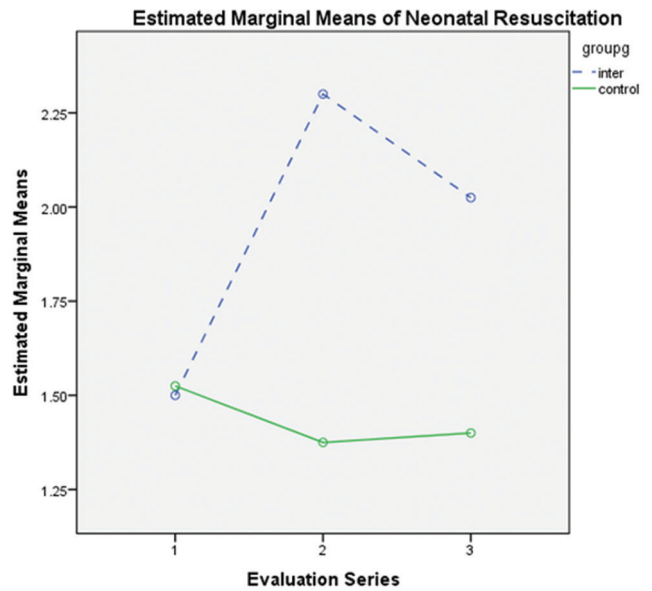


Chart 3: The comparison of self-confidence in groups A and B

Conclusion

A competency-based approach is an effective strategy to enhance the knowledge, skill, and self-confidence of midwifery students in managing neonatal resuscitation. Also, this method has resulted in knowledge, skill, and self-confidence retention. Also, OSCE design can help to maintain the students’ skills and self-confidence. In this study, we tried to use a combination of teaching strategies and evaluation methods to enhance the training outcomes and long-term sustainability.

Key points

- Lack of adequate health care skills can be effective in increasing infant mortality.
- Using a simulation-based teaching method in resuscitating a baby can help health care providers become competent enough in this skill.

Acknowledgments

This article is the result of the master’s thesis of midwifery education at the Faculty of Nursing and Midwifery, Iran University of Medical Sciences with the financial support of the UNFPA Office. The authors wish to thank these organizations, the Italian Embassy, all midwifery students participating in the project, the Center of Clinical Skills in Iran Nursing and Midwifery Faculty, and Vice-chancellor for International Affairs and Research of Iran University of Medical Sciences.

Financial support and sponsorship

This study was supported partly by a grant from the Iran University of Medical Sciences, the UNFPA Office, and the Italian Embassy in Iran.

Conflicts of interest

There are no conflicts of interest.

Approval of the Ethics Committee

This study was done in accordance with the ethics guideline of the Iran University of Medical Sciences (IR.IUMS.REC1397.026).

Registration as a clinical trial

This study was registered in the Iranian Registry of Clinical Trials (IRCT20180609040017N1).

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