Comparison of Structured Clinical Instruction Module and Video-Assisted Instructor -Led Training in Accelerating and Retention of Nursing and Midwifery Students' Skill in Neonatal Resuscitation

Fatemeh Erfanian Arghavanian (PhD)[1,2], Javad Malekzadeh (MSc)[3], Gholam Ali Mamouri (MD)[4,5], Talat Khadivzadeh (PhD)[2,6*]

[1] Assistant Professor, Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[2] Department of Midwifery, School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran
[3] Lecturer, Department of Emergency Medicine, School of Nursing and Midwifery, Mashhad University of Medical Sciences
[4] Professor of Neonatal-Perinatal Medicine, Neonatal Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[5] Department of Pediatrics, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
[6] Associate Professor, Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

ARTICLE INFO	ABSTRACT
Article type: Original article *Article History:* Received: 05-Jan-2022 Accepted: 26-Jun-2023 *Key words:* Neonate Resuscitation Students Training Clinical Skill	***Background & aim:*** Some studies have called into question medical students' competency in neonatal resuscitation. Therefore applying standard training methods has been recommended. This study compared the effect of Structured Clinical Instruction Module (SCIM) and video-assisted Instructor -led training (ILT) in accelerating and retention of students' knowledge and skill in neonatal resuscitation. ***Methods:*** In this experimental study 48 nursing and midwifery students of Mashhad University of Medical Sciences, Mashhad Iran, who did not attended in any related education, were allocated in SCIM, VT and control group through stratified randomization. In SCIM group, after lecture, six groups of students rotated through six stations, trained and practiced under supervision of six instructors. In VT group after lecture an instructional video presented then students repeated the video and discussed its content with each other and instructor. Before, after and one month following workshops all students participated in an OSCE to assess their cognitive, technical and behavioral skills. Paired t-test and One-way ANOVA were used for data analysis. ***Results:*** In post-test, both groups of SCIM and VT had better performance than control group (p<.001, p<.001, respectively). But SCIM group demonstrated a marked improvement compared with VT group (202.97±16.6 vs 173.6±15.3 (P<0.001). There was a significant difference between students' comfort and confidence in both SCIM and VT groups (P<0/001). In retention test total score between three groups showed significant difference (P<0.001); whilst the SCIM group had significantly better performance (P<0.001). ***Conclusion:*** SCIM is an effective method in acquisition and retention of neonatal resuscitation skill. So its application is recommended in the neonatal resuscitation training.

Introduction

Annually, 130 million newborns are born worldwide. Approximately 10% of all newborns need assistance and less than one percent requires intensive resuscitation at birth (1-3).

* *Corresponding author*; Talaat Khadivzadeh, Associate Professor, Department of Midwifery, School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran. Tel: 009838591511 Email: khadivzadeht@mums.ac.ir

Babies not receiving such valuable help will pass away or suffer lifetime morbidity (4-5). For this reason neonatal resuscitation has been a standard of practice for wholly neonatal nurse practitioners, midwives, staff nurses, respiratory therapists and physicians who work in maternity and neonatal wards (6-7). It has been emphasized that at every delivery at least one skilled resuscitator must be immediately available (5, 8-9).

The skill taught by the neonatal resuscitation program (NRP) has become the basis and standard of care for training resuscitation and has been obligated for all health staff (10-12). However, these programs rely profoundly on passive forms of training (6, 13).

Studies have called into question the ability of the care provider to perform neonatal resuscitation competently. Resuscitators has not frequently performed skills correctly during real resuscitations, experience notably stress and the preventable errors still occur regularly (14-15). In fact in crisis event like neonatal CPR, there is expected that the residents and staff work in the highest level of competency, however as the scarcity of such events and not being encountered during their education period they don't perform this procedure in competent manner (6, 14).

A study reported that only 41% of residents felt confident to resuscitate a child and more than half of them were unable to choose the accurate-size of endo-tracheal tube (13). Several studies have demonstrated that residents have relatively few opportunities for leading the resuscitations up to end of their academic training. They rarely have more than 20 chances to intubate during their residency training whilst, 40-60 intubation attempts are required for proficiency (16-18). The results of these studies are disconcerting and may be due to a number of factors, including training methods (16).

As it has mentioned, traditionally training CPR has been done through instructor-led course in which it is time and cost consuming, has the managerial problems and a potential to discourage many students from receiving CPR training. Training methods using video instruction and hands on practice have recently proven to be effective (19).

In some studies, it has been reported that using video in the training cardio pulmonary and neonatal resuscitation has been effective and has sustainable effect (9, 20-21).

The new training methods, such as simulation, have been developed to facilitate acquisition clinical skill (14-15). Simulation-based training cause in lowering the cost of education, reduction the training time and provides a convenient environment in which the trainee can learn without any harm to patient. In this way, the trainees have more opportunity for practice (22-23). It is crucial to apply different styles in teaching neonatal resuscitation to facilitate students` learning and sequent improve the patients` outcomes (7, 24). Even though a lot of effort has been done to find the best practices in neonatal emergencies (13, 25), however advances in educating staff are lagging behind. In particular, applying new training methods are lacked in a realistic setting (13).

Based on these matters, it is essential to develop a new method for training, in this matter Structured Clinical Instruction Module (SCIM) for neonatal resuscitations proposed. This program is novel, as it covered numerous aspects of knowledge and essential skills for resuscitations. SCIM is an instructional training method that provides students with a structured educational experience focused on a single clinical subject (26-27). Students in small groups rotate through defined stations and perform a particular task in equal amount of time at each station (26-29). SCIM was derived from the Objective Structured Clinical Examination (OSCE), in which instead of using for assessment, it is used for clinical teaching (30). This method has been used in the teaching of breast cancer management, cancer pain and surgical techniques. It is described as an effective, sustainable tool, resulting in durable skills and knowledge improvements (27, 29-33). The

International Liaison Committee on Resuscitation ILCOR has made specific recommendations to improve the resuscitation education (1)و meanwhile many student in training course, reducing training time and shortened curriculum has been considered for lesser clinical experience (14,15). Therefore this research work is preformed to compare the

effect of Structured Clinical Instruction Module (SCIM) and video-assisted Instructor -led training in accelerating and retention of students' knowledge and skill in neonatal resuscitation.

Materials and Methods

This research was an experimental study in which nursing (n=32) and midwifery (n=16) students were enrolled It was approved by the Vice-Chancellor for Research of Mashhad University of Medical Sciences, Mashhad, Iran (grant number: 88428).

After providing informed consent, students were randomly allocated in three groups through stratified randomization. To determine the sample size, the results of the pilot study were applied and the formula of comparing means between groups was used to estimate the neonatal resuscitation skill. The sample size of at least 14 students in each group was calculated, in which the final sample size was determined 16 students in each group based on 80% test power, 95% confidence interval, 5% maximum margin of error, and 10% drop-out rate. The inclusion criteria were nursing and midwifery students who had willingness to participate in the study, and those who had no serious accident or stress in the past 6 months, were healthy and not attended in any related education during the study.

In this study just one of the students in SCIM group excluded from the study because of severe stress during the study.

Data on personal, demographic and educational characteristics of students gathered using self-report questionnaires. The first group were taught by Structured Clinical Instruction Module (SCIM), the second group received video training (VT) and the third group remained untrained (control group). The two interventional groups participated in the 6 hours neonatal resuscitation workshop. Based on the Neonatal Resuscitation Program (NRP) the content and text book (reference book) in both groups was the same and before the course began, specific learning objectives were clearly identified to the learners.

In SCIM group all students were given three hour lecture about neonatal resuscitation. Then they were divided in 6 groups of 3 and 2 members, rotated through 6 stations, trained and practiced under supervision of the instructor in 30 minutes at each station. At each specific station the same instructor was teaching all the learners. In the stations 1-5 the history of a newborn who needs initial steps in resuscitation, positive-pressure ventilation (ppv), endo-tracheal intubation, chest compressions and medications were given to the students, respectively. In each station the instructors demonstrated related technique on the model with a brief tutorial base on the related scenario. After that students practiced one by one, reevaluated their resuscitationized, while the other members gave feedback to the subject. Whenever it was necessary, a team was established and worked out under supervision of the instructor. It should be mentioned that in the station 4 the model showed central cyanosis in which after effective resuscitation was disappeared and in the PPV station students taught using PPV devices as well. In the management station of 'management' (station 6) the students were given a brief history of different scenario related to advance resuscitation. The scenarios adapted from the NRP textbook. Students as a team should manage those scenarios under supervision of instructor. All technical and especially behavioral skills were practiced in this station and the students practiced with instructor as a resuscitate team.

In VT group students were received 2 hours lecture and 1 hour instructional video about neonatal resuscitation. The sessions were ended up with the discussion on those subjects. The last three hours was specified for the students to repeat the video, discussed with their team (students and instructor). They have been instructed that whenever it is necessary they pause the video, discussed about the neonatal resuscitation and in this way their training was facilitated by the instructor.

In this study 6 faculty members from anesthesiology, medical emergency, nursing and midwifery discipline participated as instructor. Separate training sessions were held for them to ensure, they would be qualified to teach neonatal resuscitation. It is worthwhile to mention that in video training group all these technical and behavioral skills and scenarios

were taught via lecture and video(from NRP`s supporting material).

Before and after the training programs, students' knowledge and technical and behavioral skill in neonatal resuscitation(n=48) were assessed through an Objective Structured Clinical Examination(OSCE) constitute of 7 stations lasted 3 minutes each station except for station one that was a group station. In this station students` knowledge (cognitive skills) about neonatal resuscitation was assessed through 20 MCQ in 10 minutes. Then students entered in the stations 2-7 one by one, in which their skill in performing Initial steps of resuscitation, PPV, Intubation, Chest compression, Medication and management of CPR was assessed. In these stations time management and students` reevaluation from the baby was evaluated as well. In the last station there was history of a meconial baby who needs advance resuscitation. In this station when the students asked for help, the observer act as a resuscitator team and all the technical and crisis resource management skills (behavioral skills) require for successful resuscitation were assessed.

In the stations 2-5 and 7 five observers who were blind to the training program rated students' performance using 3-point rating scales (correct, incorrect and not performed). These rating scales constitute of 10,6,7,6,20 items in each station. In the station 6 students' replies to appropriate dose and route of drugs were scored by two faculty staff using related checklists. All the checklists were prepared by the authors who were expert in the neonatal resuscitation based on the NRP and rated as satisfactory, unsatisfactory and not observed. The content validity of translated checklists and the questionnaire were confirmed by 10 faculties from midwifery, nursing, medical education and neonatology disciplines. Using alpha Cronbach coefficient test, the reliability of OSCE was 0.83 and reliability of 6 checklists applied in stations 2-7 were between 0.61 and 0.88. Using split-half methods, the reliability of MCQ was 0.79. All necessary instruments and clear instructions for students in each station were already provided.

The total score of neonatal resuscitation was 236(total point possible was 20,20,36,48,36,18,58 in station 1-7 respectively).

In this study students analyzed their comfort and confidence on important aspects of neonatal resuscitation before and after the program using the validated self-confidence questionnaire. They also evaluated their satisfaction from the workshops and the OSCE using validated self-assessment questionnaires (34-35). The reliability of self-confidence questionnaire, satisfaction from the workshops and the OSCE were assessed through internal consistency method with Cronbach's alpha coefficient 0.99, .89 and .95, respectively. After one month the same OSCE was conducted for 48 students who participated in this study to evaluate the extent of students` retaining knowledge and skill in neonatal resuscitation. In this study all the students who enrolled, continued to the end of the study (Figure1).

In this study all ethical aspect including informed consent, confidentiality of students` information, and opportunity to withdraw from the study if didn`t like to continue, were observed. This research has been approved in the Ethical Committee of Mashhad University of Medical Sciences (August 21, 2010). Statistical Data was analyzed using SPSS (version 11.0; SPSS Inc.,Chicago,IL) and a value of $p<0.05$ was considered significant. The results were expressed as mean ±standard deviation, and statistical differences among groups were determined by one-way analysis of variance. If there was any significant difference between any of the three groups, Tukey test was performed. In case of abnormal distribution the Kruskall-wallis test was used and in case of difference Mann–Whitney test was performed to compare the two groups.
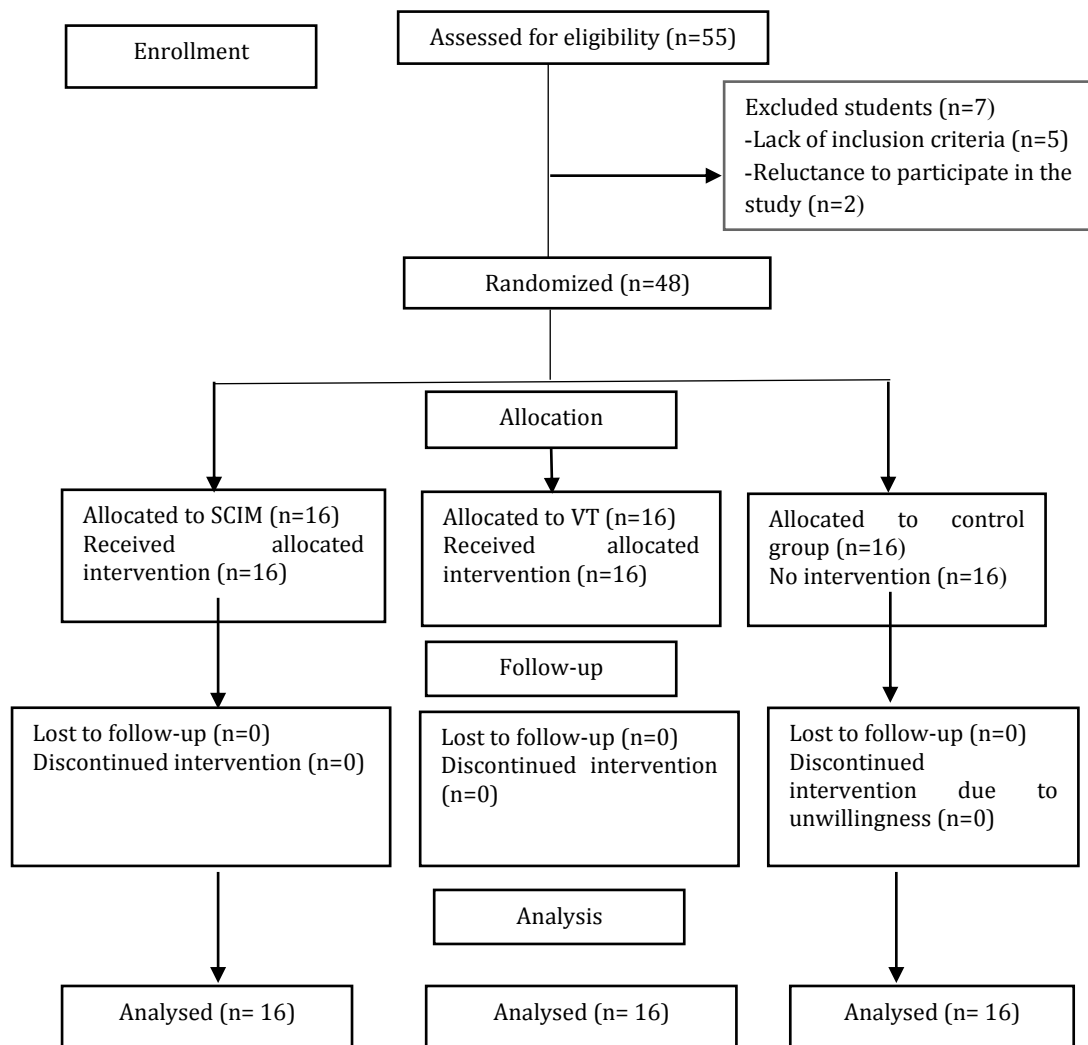
Figure 1. The CONSORT flow diagram of intervention in the three groups

Results

Of the 48 students who entered the program there were no significant differences between the students in the three groups in terms of age (p=0.4), their last grade (p=0.89) and the previous neonatal resuscitation`s sessions, which has been passed during their academic period (Table1).

In pretest the overall performance in neonatal resuscitation didn't showed significant difference (P=0.66) among three groups, whilst in the posttest there was significant difference between groups (p<0/001) (Table2).

In the posttest both intervention groups (SCIM and VT) had significantly better performance than control group (p<0/001, p<0/001 respectively), however, SCIM group demonstrated a marked improvement compared to the VT group (p<0/001) on neonatal resuscitation.

Students` score in neonatal resuscitation has been improved after attending in the training programs in SCIM group (p<0/001) and VT (p<0/001) compared to the corresponding pre intervention scores (Table 2).

Table1. Comparison of some characteristics of students in SCIM, VT and control group

Demographic and educational variables	SCIM	VT	control	P-Value
	Sd±Mean	Sd±Mean	Sd±Mean	
Age(y)	4.23±25.06	4.95±25.18	4.80±25.11	F=0.0026 P=.94
Grade Point Average	0.73±17.38	0.78±17.35	0.71±17.36	F=0.0068 P=.89
Theoretical sessions	1.3±1.5	1.28±1.71	1.28±1.6	F=0.00082 P=.97
Practical sessions	0.36±8	0.81±1.9	0.6 ±1.5	F=0.6898 P=.42

Table 2. Comparison of the students' final scores in OSCE between SCIM, VT and control group

GROUP	Pre-Test	Post-Test	Re-Test	Pretest vs. posttest/ Wilcoxon	Pretest vs. re test/ Wilcoxon
	SD±Mean	SD±Mean	SD±Mean		
Total score					
SCIM	99.13±22.98	204.26±16.86	193.71±9.94	Z=12.035 P<0.001	Z=15.110 P<0.001
VT	100.96±22.28	174.56±15.95	145.62±38.88	Z=10.365 P<0.001	Z=3.986 P<0.001
Control	93.93±23.25	95.56±21.04	94±20	Z=0.055 P=0.986	Z=0.0352 P=0.972
Result of Kruskal-Wallis test	χ^2=2.119 P= 0.66	χ^2=25.818 P<0.001	χ^2=25.858 P<0.001		

Analysis of students` skill details showed that in both intervention groups' students' performances had remarkable increase in all stations compare to control group following the intervention,. In the posttest SCIM group performed significantly better than VT in all the stations (Table 3).

Before attending in the workshop, comfort and confidence in resuscitation didn`t have any difference between three groups (p=.79). After training there was a significant difference between students' comfort and confidence in SCIM(11/2 ± 4/1 pre-test, 20/6 ± 2/36 post-tests) and VT groups(10/7 ± 5 pre-test, 17 ± 2/9 post-tests) (p<0/001) and between interventions groups compare to control group (p<0/001, p<0/001 respectively). The comfort and confidence in each intervention group had been increased significantly compared to pre-intervention (p<0/001 in each group).

The mean of course satisfaction scores in SCIM and VT groups had no significant difference

(50.6±4.02 vs. 47.3±8.8, p=.2) and students` evaluations of the courses were very positive. All the students agreed and strongly agreed that SCIM was a valuable educational experience and very beneficial. They reported that they need such a structured education for learning other competencies. There was no significant difference between three groups regarding their evaluation from the OSCE (p=.12).

In the retention test the total score between three groups showed significant difference (p<0.001) (Table 2) whilst the SCIM group had significantly better performance than VT group (p<0.001).

Although in SCIM and VT groups students` scores have been decreased significantly in the retention test compare to posttest but students` knowledges and skills were improved over their pretest scores. In all the stations SCIM group had better performance compare to VT group.

Table 3. Comparison of students' scores in seven OSCE stations between SCIM, VT and control group

GROUP	Pre-Test SD±Mean	Post-Test SD±Mean	Re-Test SD±Mean
Introduction to resuscitation			
SCIM	2.14±11.8	1.35±16.86	1.72±15.28
VT	1.99±10.68	2.15±15.62	1.58±13.12
Control	2.68±11.37	2.68±11.62	2.3±11.43
Result of Kruskal-Wallis test	=3.214χ^2	=11.765χ^2	=10.353χ^2
	P= 0.401	P<0.001	P<0.001
Initial steps of resuscitation			
SCIM	4.68±8.86	1.13±19.0	1.95±15.85
VT	3.17±8.06	4.03±14.5	4.76±12.5
Control	3.05±4.87	3.18±5.43	3.16±5.18
Result of Kruskal-Wallis test	=4.691χ^2	=18.652χ^2	=16.235χ^2
	P= 0.067	P<0.001	P<0.001
Positive-Pressure Ventilation			
SCIM	7.5±16.4	4.27±32.4	3.72±31
VT	7.08±18.37	4.37±28.31	7.57±20.87
Control	7.7±15.75	7.09±16	6.86±15.75
Result of Kruskal-Wallis test	=3.023χ^2	=21.02χ^2	=19.514χ^2
	P= 0.418	P<0.001	P<0.001
Intubation			
SCIM	10.24±11.00	10.09±41.4	5.76±40
VT	7.97±9.0	10.17±26.43	12.65±25.25
Control	9.72±11.62	9.15±12.12	8.87±11.75
Result of Kruskal-Wallis test	=1.011χ^2	=25.887χ^2	=23.148χ^2
	P= 0.711	P<0.001	P<0.001
Chest compression			
SCIM	3.2±27.0	2.65±33.8	4.31±31.85
VT	2.99±26.81	3.04±30.93	8.11±24.62
Control	9.64±23.25	8.84±23.62	8.61±23.37
Result of Kruskal-Wallis test	=4.002χ^2	=25.835χ^2	=18.194χ^2
	P= 0.169	P<0.001	P=0.007
Medication			
SCIM	5.11±7.13	3.46±18	3.26±16.28
VT	4.02±9.18	3.14±15.56	4.5±14.62
Control	3.09±10.5	2.04±10.93	1.83±10.81
Result of Kruskal-Wallis test	=3.904χ^2	=25.824χ^2	=21.041χ^2
	P= 0.06	P<0.001	P=0.001
Management of resuscitation			
SCIM	7.31±16.93	8.02±44.57	5.37±43.42
VT	10.26±18.84	5.82±43.18	17.94±34.62
Control	10.09±15.62	9.01±15.81	8.85±15.68
Result of Kruskal-Wallis test	=2.323χ^2	=21.024χ^2	=25.852χ^2
	P= 0.623	P<0.001	P<0.001
Total score			
SCIM	99.13±22.98	204.26±16.86	193.71±9.94
VT	100.96±22.28	174.56±15.95	145.62±38.88
Control	93.93±23.25	95.56±21.04	94±20
Result of Kruskal-Wallis test	=2.119χ^2	=25.818χ^2	=25.858χ^2
	P= 0.66	P<0.001	P<0.001

Discussion

In this study, the effects of two different training methods (SCIM and VT) on improvement and retention of neonatal resuscitation knowledge and skills were determined and compared with control group. This study showed both interventional groups had improvement in knowledge, relevant clinical skills and behavior of neonatal resuscitation. More over total score in SCIM increased significantly compare with VT and showed better performance in neonatal resuscitation.

The findings indicated that the students gained almost half of the total score in knowledge area in pretest which shown the lacked in CPR cognitive knowledge. Following the training program there was a significant acquisition in students` knowledge, which supports the findings of Sloan`s study (30). He demonstrated that SCIM significantly increases the clinical knowledge of surgical residents in diagnosing and treating patients with breast cancer.

The results of our study demonstrated that cognitive knowledge as measured by the pre-post training MCQ test remained equal between the SCIM and VT. The equal improvement in MCQ scores indicated that information previously presented in the SCIM can be taught as effectively through VT.

In terms of the students' neonatal resuscitation skills, the findings are more discouraging, in that at all station student gained less than 50% of total score and intubation was the poorest performed skill. This study highlighted that all students performed none of the skill competently, which is consistent with the findings of previous studies. There are reports that approximately 30% of the NRP steps are not performed or are performed incorrectly (7). Some studies show lack of competency of graduated student in neonatal resuscitation (7, 14-15, 24).

The gap between what has been learned at medical school and what is needed to function as a competent resuscitator has been identified before (36).

In the post training assessment, the findings clearly demonstrated a positive training effect of SCIM and a significant acquisition in technical and behavior skills in comparison with VT. In consistent with the Smith`s (2002) study in which the SCIM had comparable effect on teaching musculoskeletal clinical skills compare with traditional teaching methods (37). In the Sloan`s (2004) study although all three educational groups performed better on the Cancer Pain than the control group but students who received structured education obviously had better performance compare with control or traditional (CD-ROM) formats(38). Auret (2008) reported that structured teaching methods enhance palliative care in undergraduate medical students (29).

Based on the adult learning principles allowing students the opportunity to apply what they already know to the clinical encounter and showing in what areas they lack knowledge and judgment would result a powerful stimulus to learn, particularly in a small group format (38). The SCIM format affords the opportunity for reproducible teaching, so all the students in small groups have the same exposure to a clinical topic (27).

In the station 7 (Management), although competency in both groups increased after training, but there was no significant difference between two groups. It is due to that in the lecture, instructor provided and discussed different scenario related to the management of neonates in which a part of the video was about management of these cases. The time spent in this station in the SCIM was insufficient and there is some need for more practice about management of resuscitation.

In this study all students provided self-assessments of their perceived comfort and confidence on important aspects of neonatal resuscitation. Both training programs improved students` comfort and confidence compare to control group; however SCIM had stronger effect in this regard. Therefore, improvement was directly attributed to the training methods.

These findings support the Hensel `s study in which all nurses who attended in a simulation training regarding neonatal resuscitation increased their confidence (39).

After one month total score of intervention groups decreased significantly compare to posttest scores but students` knowledge and skills were improved over their pretest scores.

This finding is in consistent with the Carlo`s (2009) study in which nurse midwives` scores in retest were improved over their pretest scores despite of a deterioration compare to the posttest scores (40).

In this research the SCIM group had significantly better performance in the retention test compare to VT group in terms of students` technical and behavior skill.

SCIM has several benefits over traditional training methods: an intensive and multidisciplinary instruction relative to one clinical topic and development of its detailed curriculum, easy to update standards of care, lets uniforming teaching skills by using predetermined checklists, give an opportunity to the students to put on what they already know and to indicate what they do not know, giving direct feedback to students about their performances in a nonthreatening situation (26-27, 29, 38).

According to the WHO and other studies, training resuscitation offer the possibility of reduction in neonatal morbidity and mortality in perinatal and neonatal period; therefore this matter highlights the potential benefit of simulation-based training on patient outcomes even with using low-fidelity simulation and in structured education(14,41-43).

As the need for neonatal resuscitation is not predictable in all the case and the presence of well trained and a skilled provider is necessary to reduce the birth injury (43), it is suggested using SCIM as a new structured interventional method for training the students' skills to accelerate the technical and behavioral skill in neonatal resuscitation and their self-confidence as well. In fact using effective and simulation based training method has greater effect on the effectiveness of the teaching methods (44-45). Limitation of the SCIM is that it is resource intensive. It requires recruitment of several faculty members from different departments and cost involvement (38). These matters were the limitation of our study as well. This is the first report of the usage of SCIM as a new educational tool in the NRP in IRAN. SCIM has already been demonstrated to increase individual students' skills, such as cancer pain and breast cancer; however, there was a paucity of research involving SCIM in neonatal resuscitation. Another strength of this study is to prepare and providing a training package for the neonatal resuscitation education. It has been suggested that this method can be applied in other crucial skill for the students.

Conclusion

The findings indicated that using SCIM and VT significantly improved the students' knowledge and skill in neonatal resuscitation. Meanwhile, SCIM had stronger effect on increasing the competency of students and a positive effect on retention and durability of students' skill and their confidence as well. It is suggested that SCIM, as a novel and effective training method, is implemented in the neonatal resuscitation training course.

Acknowledgements

Conflicts of interest

The authors declared no conflicts of interest.

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