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Original Article

Production of Multimedia Neonatal Resuscitation Program and Its Effect on Self-learning for Resuscitation Skills

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ABSTRACT

Background: Neonatal resuscitation certification is essential for every neonatal doctor and nurse. During circumstances such as the COVID-19 era, when face-to-face resuscitation training is not possible, this study was designed to produce a multimedia program for newborn resuscitation in Iran and to determine its effect on self-learning of newborn resuscitation.

Methods: In this quasi-experimental study, instead of conducting a resuscitation workshop with learners present, a multimedia program for neonatal resuscitation — including a handbook, videos, and PowerPoint lectures — was first produced by professors and instructors in the skill lab. It was then delivered to the learners. Eight weeks later, they underwent a theoretical (knowledge) exam, and eight weeks after that, a practical skills exam (Megacode) was performed on a mannequin. The knowledge and skill scores obtained in the non-attendance group were compared with those from previous attendance workshops. SPSS version 18 was used for statistical analysis, and a p-value ≤ 0.05 was considered statistically significant.

Results: A total of 40 students (20 in each group) participated in this study. The mean theoretical resuscitation exam score was 18.95 ± 0.88 in the non-attendance group and 17.90 ± 1.18 in the attendance group (p = 0.003). The mean Megacode exam score was 18.67 ± 0.79 in the non-attendance group and 17.92 ± 0.71 in the attendance group (p = 0.003).

Conclusion: This study showed that watching the multimedia program on newborn resuscitation followed by practice in the skill lab can be as effective in increasing learners' knowledge and skills as attending traditional resuscitation workshops.

Keywords: Clinical skills training center, Content production, Media, Newborn, Resuscitation

Introduction

The neonatal resuscitation certificate is essential for every doctor and nurse who cares for newborns in a hospital. To obtain this certificate, trainees must pass a knowledge-based (theoretical) exam on neonatal resuscitation and a practical skills exam (Megacode), in which they perform each resuscitation skill on a mannequin in a skills lab. If the trainee passes both the

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theoretical and practical exams, the certificate is issued.

Typically, to obtain a neonatal resuscitation certificate, the trainee must first register. If they pass the theoretical exam based on the neonatal resuscitation textbook, they then attend an in-person practical workshop where instructors teach the relevant lessons and the trainee practices the skills on a mannequin.

In one study, the success rate and overall quality of neonatal intubation performed by neonatal and pediatric trainees in Canada did not meet NRP standards. Specifically, the time required for intubation by pediatric residents and neonatal fellows was concerning. It was concluded that reassessment of training methods and formal exposure to neonatal intubation in pediatric and neonatal fellowship programs in Canada is needed (1).

During the COVID-19 pandemic and in other similar crises, when attending traditional in-person workshops is not feasible, trainees adopt an innovative approach: they learn skills at home by watching recorded videos of the relevant lessons performed by the instructor on a mannequin. They then attend a small-scale session alone or with at least one other person in the skill lab, where they practice the skills on a mannequin while watching the videos. Once the trainee feels fully confident in performing the skills, they notify the instructor that they are ready to take the practical exam in the instructor's presence. The exam is conducted using a checklist that assesses the skills, and the scores are graded out of 20. The theoretical exam scores are classified into two categories: fail (less than 17) and pass (17 or higher). Overall, scores above 17 are considered passing, and the resuscitation certificate is issued. The pass rates and scores are then compared with those from the most recent traditional two-day workshop attended by trainees in person.

This study aims to produce multimedia content on neonatal resuscitation and subsequently determine the effect of self-learning via the produced videos in the skill lab on the teaching of neonatal resuscitation skills during the COVID-19 pandemic (1).

Methods

This quasi-experimental study was conducted on trainees working in NICUs, neonatal wards, delivery rooms, and neonatal operating rooms in hospitals affiliated with Babol University of Medical Sciences, Iran.

Instead of holding an in-person neonatal resuscitation workshop, each neonatal resuscitation maneuver was performed by an instructor on a mannequin at the Clinical Skills Training Center (skill lab) and filmed for instructional purposes.

Trainees were then provided with the neonatal resuscitation handbook and a multimedia program DVD, developed with the participation of neonatal faculty members from universities in Region 1 of the country. They were given two months to review the materials. Before attending the virtual workshop, a knowledge-based exam covering the content of the neonatal resuscitation handbook was administered.

The neonatal resuscitation curriculum consists of 11 lessons, each containing several practical skills. These skills were demonstrated and recorded by neonatal resuscitation instructors at the Shafizadeh Amirkola Children's Hospital Skill Lab, affiliated with Babol University of Medical Sciences.

The multimedia program delivered via DVD consisted of the following components:

Neonatal Resuscitation Handbook

Prepared by neonatal faculty members from universities in Region 1 of the country under the direction of the research project manager. This section allowed trainees to study the lessons accompanied by illustrative images, thereby improving their theoretical knowledge.

Slides from the 11 Neonatal Resuscitation Lessons

Trainees could review the prepared slides from the neonatal resuscitation handbook.

Lecture-Based Lesson Presentations

The 11 lessons were presented by instructors and recorded using the Adobe Connect program from the previous neonatal resuscitation workshop. Trainees could watch and listen to these presentations.

Short Educational Videos Produced in the Skill Lab

This section featured instructional videos of essential neonatal resuscitation skills produced by instructors and trainers.

Trainees could repeatedly study the slides, watch the video presentations by the instructors, and view the recorded skill demonstration videos to enhance their neonatal resuscitation knowledge and skills.

After the trainees received the program and

studied it, a theoretical (knowledge-based) exam was administered, followed eight weeks later by a practical resuscitation exam (Megacode) in the skill lab on mannequins. Each skill was assessed using a checklist, and the scores were recorded.

The scores from the theoretical and practical exams were classified into two categories: fail (less than 17) and pass (17 or higher).

The ADDIE instructional design model was used in this study for the development of the educational videos.

Step 1: Analyze

First, eligible individuals, including pediatric residents, neonatal fellows, and nurses working in NICUs, neonatal wards, operating rooms, and delivery rooms, were enrolled. Their learning needs, required budget, methods, limitations, and project timeline were determined. The neonatal resuscitation handbook was provided to them for study, and after two months, a theoretical exam based on the 11 lessons was administered. The theoretical exam scores (continuous) were recorded quantitatively.

Step 2: Design

In this phase, the most suitable educational environment was selected — the Skill Lab at Amirkola Children's Hospital. The trainees practiced on mannequins in the skill lab. Eight weeks after the workshop, the practical Megacode exam was conducted.

Step 3: Develop

At this stage, with the assistance of a videographer, video clips of the instructors performing neonatal resuscitation skills were recorded in the skill lab. These clips were then incorporated into the neonatal resuscitation multimedia program. Each lesson was also recorded as a lecture by the instructors using slides and incorporated into the DVD.

The multimedia neonatal resuscitation DVD, containing the instructional videos, was given to the trainees, allowing them two months to study and repeatedly view the videos. Additionally, the trainees were permitted to attend one session in the skill lab in groups of 3–5 people, where they could practice on mannequins while watching the videos under the supervision of an instructor.

Step 4: Implement

After the DVD was distributed to the trainees, they were asked to read the handbook, repeatedly watch the video clips, and practice the skills in the skill lab.

Step 5: Evaluate

Educational-knowledge evaluation (pre-test) was conducted using multiple-choice questions two months after the start of the self-study phase. If the trainee achieved a score of 17 out of 20, they were eligible to take the practical skills exam. The practical exam (Megacode) was conducted eight weeks after the pre-test, following viewing of the skills on the DVD and practice in the skill lab. The practical exam was administered in the skill lab with the presence of an instructor, using a checklist to assess the skills.

If the trainee achieved the minimum required score in both the pre-test and the Megacode exam, they were deemed eligible to receive the neonatal resuscitation certificate.

To compare this remote workshop method with traditional in-person neonatal resuscitation workshops held in the skill lab, workshops No. 14 and No. 15, which were conducted under non-pandemic conditions (2018 and 2019) with comparable trainees, were selected as the control group. The theoretical and practical exam scores from both methods were recorded and classified identically (as continuous quantitative variables) and compared.

SPSS version 18 was used for statistical analysis. Numerical variables between the two groups were compared using the Student's t-test, and a p-value ≤ 0.05 was considered statistically significant.

Ethical approval

This study obtained ethics committee approval (Ethical code: IR.NASRME.REC.1400.407).

Results

A total of 20 trainees, including residents from neonatal intensive care, neonatal wards, and pediatric residents, participated in this study after studying the multimedia neonatal resuscitation program. For comparison, another group of 20 trainees with similar conditions from a previous in-person workshop was selected. The theoretical (knowledge) scores and Megacode practical exam scores were extracted and compared. The mean theoretical score for the non-in-person group was 18.95 ± 0.88, while for the in-person group it was 17.90 ± 1.18 ($p = 0.003$). The mean Megacode exam score for the non-in-person group was 18.67 ± 0.79, compared to 17.92 ± 0.71 for the in-person group ($p = 0.003$).

The comparison of theoretical exam scores and study results is illustrated in Figures 1 and 2.

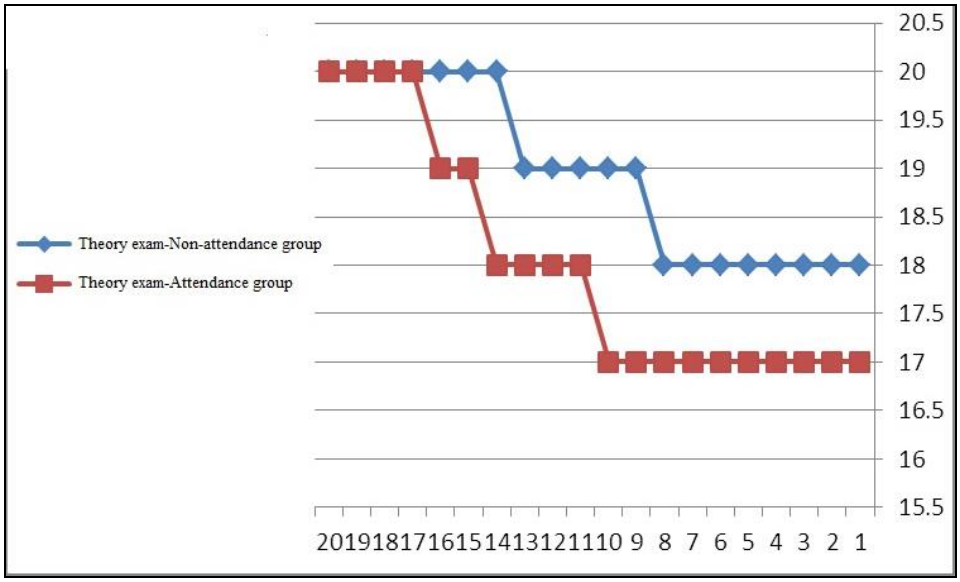

Figure 1. Comparison of Theoretical Exam Scores in non-attendance and attendance groups

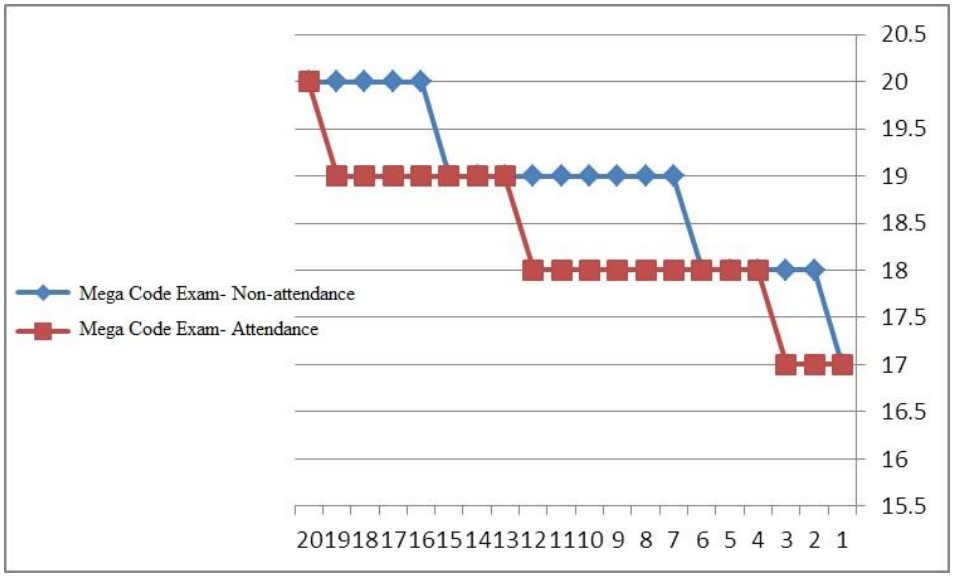

Figure 2. Comparison of Mega Code Exam Scores in non-attendance and attendance groups

Discussion

Our study, as an experimental investigation conducted after producing the multimedia neonatal resuscitation program and distributing it to trainees for certification, demonstrated that viewing the multimedia neonatal resuscitation program followed by practice in the skill lab can be as effective as attending in-person resuscitation workshops in enhancing trainees' knowledge and skills.

In a cross-sectional study from Babol University of Medical Sciences, researchers evaluated 55 nurses from Babol hospitals who had received their neonatal resuscitation certification less than two years prior. They were given only the updated neonatal resuscitation textbook and were instructed to study it, followed by practical training in the skill lab under a trained instructor. Five weeks later, knowledge exams based on the textbook and a Mega Code skills exam were conducted using a skills assessment checklist. Scores below 51 out of 100 were considered below expectations, 51 to 53 were deemed as expected, and scores above 53 were classified as good. The average scores from this workshop were compared with those from self-study. The

results indicated that self-study was more effective in improving theoretical knowledge of resuscitation compared to practical resuscitation skills, suggesting that workshops should be conducted to enhance practical skills (2). In contrast, our study provided a comprehensive multimedia neonatal resuscitation program that included a handbook, lectures, and videos produced in the skill lab.

In another study comparing the effectiveness of self-directed neonatal resuscitation skills training using video with facilitator-led training, a multicenter, randomized, controlled trial assessed the impact of two instructional methods for basic neonatal resuscitation skills using bag-mask ventilation. One group received training with a facilitator (Ins-Video), while the other did not. Novice providers watched an educational video and practiced using the video. A structured clinical examination (OSCE) measured skills performance and a written knowledge test was administered. Out of 134 students who completed the course, 63 of 68 (92.6%) in the self-video group and 59 of 66 (89.4%) in the instructional video group demonstrated competency in positive pressure ventilation (the primary outcome). However, the OSCE pass rates were low in both groups. Knowledge survey scores were comparable between the groups. The conclusion was that self-directed video training improved positive pressure ventilation skills and theoretical knowledge for novice providers but was insufficient for mastering initial neonatal resuscitation in a simulated environment (3).

Additionally, another study assessed the application and effectiveness of various educational strategies for teaching cardiopulmonary resuscitation (CPR) skills. It aimed to evaluate the impact of traditional, case-based, and web-based teaching methods on acquiring and retaining CPR skills among ninety university students (52 women, 48 men) who chose a first aid course. Students were randomly assigned to case-based and web-based training groups and were assessed three times (pre-test, post-test, and retention test for CPR skills using a skill reporter and observation checklist). Based on chest compressions measured on a mannequin, the web-based training group performed poorly compared to traditional and case-based groups. Students in the traditional and case-based training groups demonstrated better CPR performance than those in the web-based training group (4).

In another study, the effectiveness of simulation-based neonatal resuscitation education (SBE) was compared with traditional training methods for nursing students. The study aimed to evaluate the impact of SBE on nursing students' knowledge, involving 80 nurses selected through convenience sampling. Data were collected using a standardized questionnaire based on the Neonatal Resuscitation Program (NRP; 7th Ed, 2016). There was no significant difference in neonatal resuscitation knowledge levels between the two groups in the pre-test ($p = 0.452$). However, post-test comparisons revealed that the average score of students in the SBE group was significantly higher than that of the traditional group ($p < 0.001$). The conclusion was that SBE was significantly more effective than traditional neonatal resuscitation training (5).

Instructors in neonatal resuscitation programs often spend most of their class time lecturing and demonstrating fundamental skills. One study hypothesized that a self-directed education program could enhance skill acquisition outside of the classroom, reduce class duration, and allow instructors to use their time to facilitate simulations with accurate explanations. Novice providers were randomly assigned to either self-directed training or a traditional class. The self-directed participants received a textbook, educational video, and portable equipment kit, and attended a 90-minute simulation session with an instructor. The traditional class consisted of 6 hours of lectures and instructor-led skills stations. Outcome measures included resuscitation skills (Mega Code assessment score), content knowledge, participant satisfaction, and confidence. Forty-six participants completed the study, and there was a significant difference in Mega Code assessment scores between the two groups. The conclusion was that self-directed education, by shifting cognitive and foundational skill acquisition outside of the classroom, allowed instructors to improve the educational efficiency of neonatal resuscitation courses while significantly reducing course duration (6).

Limitations

Psychological effects of COVID-19 on learners: One of the learning components involves presence in the skill lab in addition to repeatedly watching the DVD. The fear of contracting COVID-19 may manifest differently among learners, potentially impacting their learning experience.

The effects of time lapse on theoretical and

practical knowledge of resuscitation: The control group from two years ago, which operated under non-COVID conditions, may show slight differences compared to the newly established non-in-person groups, despite attempts to match learners.

Conclusion

The results of our study indicate that viewing the multimedia neonatal resuscitation program followed by practice in the skill lab can be as effective as attending in-person resuscitation workshops in enhancing learners' knowledge and skills.

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Conflicts of interest

The authors declare that they have no competing interests.

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