The Effect of Virtual Interactive Education versus In-person Workshop on Nurses' Knowledge and Performance in Neonatal Skin Care in Neonatal Intensive Care Units: A Quasi-experimental Study

Shahnaz Zolghadr Nasab[1], MSc; Nasrin Khalesi[2], MD; Afsaneh Dehnad[3], PhD; Mahboobeh Rasouli[4], PhD; Leili Borimnejad[5]*, PhD

[1]Neonatal Intensive Care Nurse, Iran University of Medical Sciences, Tehran, Iran
[2]Department of Pediatrics, School of Medicine, Hazrat-e Ali Asghar Pediatrics Hospital, Iran University of Medical Sciences, Tehran, Iran
[3]Department of Virtual Education, Iran University of Medical Sciences, Tehran, Iran
[4]Department of Biostatistics, Faculty of Health, Iran University of Medical Sciences, Tehran, Iran
[5]Nursing Care Research Center, Center for Educational Research in Medical Sciences (CERMS), Iran University of Medical Sciences, Tehran, Iran

ABSTRACT

Background: Given the international recognition concerning the importance of digital literacy, and the increasing understanding of its importance in active learning, virtual education has recently attracted a great deal of attention. This method has provided an opportunity for teaching innovation in times of COVID-19. In this study, we aimed to compare the effects of virtual interactive education on improving nurses' knowledge and performance in neonatal skin care.

Methods: This quasi-experimental pre-post study was performed on 100 nurses working in the neonatal intensive care units. The participants were divided into three groups, namely the in-person workshop (n=34), virtual interactive education (n=33), and control (n=33). The instruments included Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN) standardized questionnaire. The t test, exact fisher, and repeated measures ANCOVA were conducted to analyze the data using SPSS V. 16 software.

Results: The results revealed a significant difference between the pre- and post-test scores of workshop and multimedia groups in terms of the mean score of knowledge compared to the control group (P<0.001). Similarly, there was a significant difference between the pre- and post-test scores of the workshop and multimedia groups concerning the mean score of performance compared to the control group (P<0.001). The mean score of knowledge and performance increased in both multimedia (20.76±1.30) and workshop groups (15.32±1.95) after the intervention, but the mean score in the multimedia group was more than that of the workshop group (P<0.001).

Conclusion: According to the results, the virtual multimedia training method could be used as a solution to address the growing demand for training nursing staff provided that we could lay the required foundation and design the right training methods.

Keywords: Virtual interactive education, In-person workshop, Newborn, Skin care, Knowledge, Performance

Introduction

Given the international recognition of the importance of digital literacy, alongside the mounting recognition of its importance for active learning, virtual education has recently attracted a great dela of attention. This method has provided an opportunity for teaching innovation in times of COVID-19. Maintaining skin integrity is believed to be essential for the health of infants, especially premature and hospitalized infants, as they are often under the constant intervention of a multidisciplinary team. Moreover, performing invasive methods, the use of disinfectants, adhesives and monitoring sensors, and exposure to bacterial flora are common in the hospital (1-3). A number of studies in Iran have shown the incidence of diaper dermatitis in hospitalized infants to be approximately 50.9% (4). Other prominent lesions include penetration, perforation therapy, and serum therapy, and adhesive lesions pressure sores and wounds were related to the use of non-invasive ventilation (5, 6). These lesions are serious events that cause pain, prolonged hospitalization, and the risk of infection, as well as increased hospitalization costs (7). The neonatal nurses are recommended to be aware of the skin characteristics of the neonates and evaluate them carefully to prevent therapy-associated iatrogenic lesions (8, 9). Therefore, the nurses are responsible for updating their knowledge and skills in the field of creating strategies maintaining the integrity of the skin in order to reduce the frequency and severity of injuries caused by routine care procedures, minimize the complications in this field, and maintain the quality of life (10, 11). Several methods have been proposed for continuous training of nurses. However, there is still no agreement on the best way for them to learn these methods (12-15). Recent technological advances in the use of computers and mobile phones in education, limitations in the implementation of face-to-face programs, challenges in coordinating nursing work programs, and continuing education programs have led us to conduct this study aiming to compare the effects of workshop and virtual interactive education on the improvement of nurses' knowledge and performance in neonatal skin care.

Methods
Study Design

This quasi-experimental research, using pre- and post-test was conducted with a control group and two intervention groups from December 2020 to August 2021.

Setting

The statistical population included all the nurses working in the neonatal intensive care units affiliated to the Hospital of Iran University of Medical Sciences.

Participants

The inclusion criteria were a Bachelor of Science degree (or higher), work experience of more than six months in the NICU, and having access to a computer, an online system, or a smart mobile phone. The exclusion criteria were unwillingness to continue participation for any reason, displacement of the nurses from the NICU to other wards during the research, absence in the educational sessions (workshop), and not checking the multimedia interactive file (LMS) system.

Sample Size

The present study was designed in the form of an experimental analysis of variance, in which the sample size required in each group was estimated based on the following formula:

$$n_1 = \frac{2(Z_{1-\alpha/2} + Z_\beta)^2}{[(\mu_1 - \mu_2)/\sigma]^2}$$

In which the common deviation of nurses' knowledge in the two groups, the value of which in the study Varaei et al., 2016 is estimated to be 3.07, between the two groups, $Z_{\alpha/2}$ is a constant coefficient determined by the level of error of the first type. Z_β will be the value corresponding to the second type of error (16), $Z_{\alpha/2}$ is a constant coefficient determined by the level of error of the first type, and Z_β is the value corresponding to

the second type of error (1, 17).

Accepting the error level to be 5%, $z\_(a/2)=1.96$ is obtained. Considering the test power of 8%, the value of $Z\_b=0.842$.

$$n = \frac{2 \times 3.07^2 \times (1.96 + .842)^2}{2/1^2} = 33$$

Randomization

Primarily, the names of all the hospitals affiliated to the Iran University of Medical Sciences that had neonatal intensive care units were written in sealed envelopes. Subsequently, the sealed envelopes were allocated in three groups by someone outside the research team, namely the multimedia, face-to-face workshop, and control groups. The nurses were selected based on the inclusion criteria in each hospital. We recruited 34 people in the face-to-face workshop group, 33 in the virtual interactive (multimedia) training, and 33 in the control group.

Teaching Interventions in Intervention and Control Groups

Educational Content

The educational content was based on AWHONN/NANN Neonatal Skin Care Research-Based Clinical Practice Guideline (18), including:

Assessment of the neonate's skin condition and identification of skin injury, normal newborn bathing, cord care, protecting the optimal skin function, and minimizing future skin sensitization, identification of neonates at risk for alterations in skin integrity, including exposure to environmental and therapeutic agents.

The educational content was the same in the two groups.

Face-to-face Workshop

In the first group, a face-to-face workshop was held in the main hall of the research center for two days. The workshop comprised 4 hours for theory and 2 hours for practical sessions. The participants used a simple neonate manikin in the practical session. The workshop was repeated twice according to the participants' free time schedule.

Virtual Interactive Education

In the multimedia group, the pre-test questionnaires uploaded at the beginning of the slides and the same content taught in the face-to-face workshop were interactively designed and uploaded to the university e-learning system using Storyline software. The participating nurses could access the content whenever they wished. Notably, the system could be run on a mobile phone as well. While accessing the materials, the learners answered the questions designed in the story line, and if they answered incorrectly, they were sent back to the relevant subject for additional training; if they answered correctly, they went to the next stage.

Control Group

In the control group, we distributed the pre-test questionnaires. No educational intervention was carried out

Data Collection Tools

The nurses' knowledge and performance were evaluated at the baseline and two months after the intervention. The following tools were used for data collection in the current research:

1- Demographic details: This form contained the demographic data of the NICU nurses, including age, clinical experience, history of NICU work, work shifts (morning, evening, night, rotational), education level, marital status, and completed courses regarding neonatal skin care. To assess the knowledge and practice of the nurses, we utilized Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN)/ National Association of Neonatal Nurses (NANN) standardized questionnaire designed by (17) and modified based on the 2018 guidelines; it was translated into Persian by a linguistic specialist familiar with medical terms and back translated to English, following which it was approved and provided to the participants after confirmation of validity and reliability.

To confirm the validity, the questionnaires were given to several neonatologists and faculty members knowledgeable in this field to check the appropriateness of the content, comprehensibility, format, and writing of the questions. Based on their opinions and the guideline of 2018, the necessary changes and corrections were made. The responses were calculated based on the content validity ratio and matched with the Lawshe Table. Acceptance of items based on the content validity index score was over 0.70. To confirm the reliability, the approved questionnaires were tested in 10 neonatal ward nurses who did not participate in our study, as a pilot test in order to check the comprehensibility of the questions. Cronbach's alpha of 0.703 was obtained for the Knowledge Questionnaire.

The first part of this tool has 25 multiple-choice items and evaluates the nurses' knowledge of neonatal skin care in the NICU. The correct responses are scored one, while the incorrect ones are scored zero. The score ranges of show extremely poor (0-5 points), poor (6-10 points), moderate (11-15 points), good 16-20 points), and excellent knowledge (21-25 points).

The second part contains 34 items, including 27 with one correct answer and eight without a correct/incorrect answer in the form of various issues, such as bathing neonates, using ointments and emulsions, disinfectants, rubber patches, diaper dermatitis, dehydration control in very-low-weight newborns, feeding infants, care for umbilical cord and circumcision (male infants), as well as skin tear and its prevention/treatment. This instrument was applied for measuring the nurses' performance in neonatal skin care in the NICU with correct test and essay-type answers. The correct answers were scored one while the incorrect ones were scored zero. In addition, the answers to the essay-type questions were evaluated and analyzed, and the nurses' performance was assessed within the score ranges of 0-5, 6-10, 11-17, 18-22, and 23-27, indicating extremely poor, poor, moderate, good, and excellent performance, respectively. α=0.730 was obtained for the

Performance Questionnaire.

Statistical Analysis

Data analysis was performed in SPSS version 24 using descriptive statistics (central and dispersion indices, frequency, and percentage), kruskal wallis test one-way analysis of variance (ANOVA), paired t-test, and analysis of covariance (ANCOVA). In all the statistical analyses, a P-value of 0.05 was considered to be significant.

Results

A total of 100 eligible nurses completed the demographic questionnaire and accordingly entered the current study. According to the evaluation of the demographic characteristics of the nurses, the majority of them were aged 30-39 years. No significant differences were observed between the study groups in terms of the mean age (P=0.568), clinical experience (P=0.143), work shifts (P=0.867), the level of education, and completed courses in neonatal skin care (P=0.680). (Table 1)

The paired t-test showed that the mean score of knowledge in the workshop group significantly increased from 11.85±2.1 (pre-test) to 15.32±1.95 (post-test; P<0.001). Most of the participants in the workshop group had poor and moderate knowledge levels, which improved to moderate and good after the intervention. Moreover, there was a significant difference in the workshop group between the pre-test (12.85±2.42) and post-test (17±2.17; P<0.001) concerning the mean score of performance. (Table 1)

In the virtual interactive education group, we observed a significant difference in the mean score of knowledge before and after the intervention (P<0.001) based on paired t-test. In this group, the majority of the participants had a moderate knowledge level before the training, which improved to good and excellent levels after the intervention. The mean scores of knowledge of the participants also increased from 11.70±2.30 to 20.76±1.30 following the intervention (Table 2). In the same group, the performance score of the participants significantly changed from

Table 1: Frequency distribution table of the age of the studied units in the three groups and the results of the mean comparison test - 2020-2021

		Control		Workshop		Multimedia	
		N	P	N	P	N	P
Age (years)	20-29	9	27.27	7	59.20	9	27.27
	30-39	7	21.21	7	59.20	14	42.42
	40-49	16	48.48	19	88.55	10	30.30
	>49	1	03.3	1	03.3.2	0	0
	Mean±SD	15.50±3.064		16.33±4.39		16.70±3.169	
	kruskal wallis	P=0.568					
NICU working History (years)	1-5	12	36.36	9	47.26	13	39.39
	6-10	10	30.30	15	12.44	13	39.39
	11-15	10	30.30	10	41.29	7	21.21
	16-20	1	03.3	0	0	0	0
	Total	33	100	34	100	33	100
	Mean±Sd	92.4±25.8		24.6±5.8		18.6±25.8	
				P=0.524			
Education							
	Bachelor	27	82.81	27	18.91	33	100
	Master	6	18.18	6	82.8	0	0
	Total	33	100	34	100	33	100
	Mean±Sd	85.14±5.16		80.19±17		33.23±5.16	
Marriage	Single	29	88.87	29	29.85	22	67.66
	Married	4	12.12	5	71.14	11	33.33

P-value=0.064; Fisher exact test

Table 2: Comparison of the mean scores of the knowledge among the study groups

Knowledge groups	Mean±SD		Paired t-test results
	Pre-intervention	Post-intervention	
Work shop (n=34)	11.85±2.10	15.32±1.95	T=-8.95, P<0.001
Multimedia (n=33)	11.70±2.30	20.76±1.30	T=-23.43, P<0.001
Control (n=33)	12.88±1.92	13.34±2.09	T=-1.677, P=0.103
Independent t test results	F=1.947, P=0.148	f=3.811, P<0.001	

P<0.05 set as the level of significance

Table 3: Comparison of the mean scores of the performance frequency distribution among the study groups

Performance	Mean±SD		Paired t-test results
	Pre-intervention	Post-intervention	
Work shop (n=34)	12.85±2.42	17.00±2.17	T=-13.35, P<0.001
Multimedia (n=33)	11.79±1.14	19.58±1.98	T=-21.12, P<0.001
Control (n=33)	12.88±1.39	13.06±1.61	T=-1.063. P=0.296
Independent t test results	F=2.180, P=0.119	F=0.221, P<0.001	

P<0.05 set as the level of significance

11.79±1.14 to 19.58±1.98 after the intervention (P<0.001) (Table 3).

The results revealed a significant difference between the pre- and post-test scores of the workshop and multimedia groups in terms of the mean score of knowledge compared to that of the control group (P<0.001) (Table 2). Similarly, there was a significant difference

between the pre- and post-test scores of workshop and multimedia groups in terms of the mean score of performance compared to that of the control group (P<0.001) (Table 3). The mean score of knowledge and performance increased in both multimedia and workshop groups after the intervention, which was however greater in the multimedia group (P<0.001).

Discussion

The results of the present study indicated that the increase in knowledge levels and performance in the multimedia group was greater than that in the workshop group. In line with these results published by Kedivar et al. (2018), who aimed to investigate the effect of virtual education on neonatal nurses' caring ability at the NICU, the results showed a significant difference between the e-learning compared to traditional education methods. They concluded that the greater impact of e-learning is owing to more professional involvement of nurses and lack of time to study using the traditional method (19).

Furthermore, consistent with our findings, Aredes et al. (2017) reported a significant increase in the cognitive learning of neonatal nurses after using a computer simulator (20). Notably, the use of technology may partly account for the success of such educational courses. In addition, our results demonstrated that virtual interactive systems could be an important educational method for learning innovation and motivation in health care.

In another research, (21) evaluated the effect of network-based training on the knowledge of NICU personnel, reporting significant differences in the scores of the subjects before and immediately after multimedia training (P=0.001). Additionally, the aforementioned study indicated the improvement of knowledge score in the intervention group. However, our findings are consistent with those reported by Zamani et al. (2019) regarding the positive effects of this training method on the increased level of performance in nurses in the area of neuroprotection in infants. In the foregoing

study, a limitation was the impossibility to use the content on mobile phones, which was not an issue in the current research (22).

On the contrary to the results of the present study, Lahti et al. (2014) concluded that while e-learning could enhance learning in the participants compared to the conventional education method, the difference was not significant (P=0.390) (23).

Similar results have been obtained in an investigation by Hashemi et al. (2016) who aimed to compare the learning levels of nurses regarding chemical factors using web-based e-learning, multimedia software package, and lectures. The researchers reported the higher mean score of the multimedia group compared to the lecture and web-based groups. Meanwhile, multimedia and web-based training methods had similar effects on learning levels in the mentioned research, with the learning score of the subjects being higher in the multimedia group and a significant difference between the three groups concerning the mean score of learning levels after the intervention (22).

Consistent with our findings, Valizadeh et al.(2016) evaluated the effects of teaching on the prescription and calculation of drugs through lecture and multimedia training on learning of the participants, reporting no significant differences in this regard (24).

Many other studies have investigated the effectiveness of multimedia training method on the knowledge and performance of nurses (16, 25), which are in line with our study.

The results of another study with the aim of evaluating the effect of e-learning and lectures on learning Maternal and Child Health Nursing demonstrated that the level of learning in both traditional and electronic methods were similar; however, this study, in agreement with ours, showed the significant effectiveness of e-learning on improving the ability of nurses (19). Similar to these results, in the paper of (26), it was found that knowledge of the nurses about AIDS in both web-based and face-to-face continuing education methods increased in the post-test in comparison with the pre-test. Generally,

they suggested these methods to be equally effective.

Limitations and Suggestions

The present work faced three limitations. To begin with, overcrowding in the neonatal intermediate care unit and the lack of adequate time for nurses to participate in the workshop despite their desire could be mentioned. Secondly, there were certain restrictions on holding workshops in the research units and a number of transportation-related problems for the participants. Ultimately, there were restrictions on practical training that had to be done on manikins and it was not really possible on a baby in the ward. We could recommend that further research be conducted on the effect of interactive simulators on Nurses' Knowledge and Performance.

Conclusion

This study confirmed the effectiveness of neonatal skin care training and retraining courses on the NICU nurses. According to the results, the workshop and multimedia training methods had positive effects on the knowledge and performance of the nurses, with the latter exerting a more significant impact. Therefore, virtual multimedia training method could be used as a solution to address the growing demand for nursing staff training provided that we are able to lay the required foundation and design the right training methods. Considering the outbreak of COVID-19, the virtual multimedia technique seems suitable as a mean to increase the knowledge of nurses and improve their performance and skills. Hence, it is suggested that this method be used in nursing education.

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Authors' Contribution

Sh.Z: conducting virtual educational sessions, conducting data collection for the in-person sessions; N. Kh.: the conception and design of the study, scientific consular, conducting the in-person sessions;   A. D: data interpretation, revising the article; M R: statistical analysis; Correspondent Author: L. B.: coordinating and conducting the study, drafting and final revision of the article.

Conflict of Interest: None declared.

Ethical Considerations

The research objectives were explained to the participants; they were ensured of the confidentiality of their personal information. All the subjects voluntarily participated in this work, and informed consent was obtained from them prior to the beginning of the research. Of note, eight subjects were excluded as they did not meet the inclusion criteria. After the intervention, the participants of the workshop group received an educational score for attending the workshop, and the subjects in the multimedia group were given a letter of participation. All the study groups received an educational file as a gift. The Research Ethics Committee of Iran University of Medical Sciences approved this project (IR. Iums.Rec.1398.441).

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