Research Paper:

Evaluating Nursing Electronic Training Course of Neonatal Stabilization Before Transport

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ABSTRACT

Background: Stabilization of the vital components of neonates before the transport significantly affects their response to treatment. This study aims at evaluating the effects of electronic learning on neonatal stabilization before transport on nurses' knowledge.

Methods: The current quasi-experimental, case-control study of e-learning of neonatal stabilization before the transport was conducted in 10 weeks in 2015 on nurses and midwives taking care of newborn infants. Three teaching hospitals in Tehran, Iran, were randomly selected and samples were selected using the convenience sampling method. The samples were allocated to two groups, intervention (n = 40) and control (n = 41). Data collection was conducted using two questionnaires on demographic information and a researcher-made multiple-choice questionnaire to assess the level of knowledge. Collected data were analyzed with SPSS version 18 using paired t and Fisher exact tests, $P < 0.05$ was considered as the level of significance.

Results: In the current study, both the intervention and control groups were homogeneous in terms of demographic characteristics. A significant difference was also observed in the knowledge level of the intervention group between the pre- and post-intervention measures ($P < 0.001$), but the same difference in the control group was insignificant ($P = 0.16$). There was also a significant difference between the study groups in terms of pre- and post-intervention comparisons ($P < 0.001$).

Conclusion: E-learning of neonatal stabilization before transport improved the knowledge of participants in the intervention group. It seems that implementation of the same training courses at large scales can improve the therapeutic results of transported neonates.

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1. Background

Health measures are evaluated with maternal, fetal and neonatal mortality rate during pregnancy or after birth (Nakhshab & Vosoughi 2010). Proper healthcare measures during pregnancy and after delivery (immediately after birth) prevents complications both for the mothers and the infants, helping the healthcare providers to deliver proper and timely clinical aids at birth and during the first week of life. This leads to prevention of two-thirds of the total neonatal mortality by immediate identification and management of problems (WHO, 2016a). Infants born prior to the 37th week of gestation are called preterm. The birth rate of preterm infants increased almost in all countries (WHO, 2015), and infections or maternal chronic diseases such as diabetes mellitus and hypertension, were of the prevalent common reasons (WHO, 2017).

Neonatal diseases are generally rapid and progressive (Karlsen 2003). Hence, preterm infants or neonates born with diseases in medical centers which are not equipped adequately to take care of such infants, should be transported to the centers with the Neonate Intensive Care Units (NICUs) (Karlsen 2003; Martínez Verónica et al. 2011, Barfield et al. 2012). Therefore, in most of the cases inter- or intra-hospital transport should be administered in order to provide intensive care to the infants under critical conditions (Blakeman & Branson 2013). Clearly, prenatal intrauterine transport of infants is superior to postnatal transport (Dukhovny et al. 2011; Martínez Verónica et al. 2011; Dalal, Vishal & Solanki 2013). But, complications and problems in all the infants are not detectable before birth. On the other hand, about 40% of prenatal problems occur during the labor (Martínez Verónica et al. 2011).

It should be considered that the stabilization of clinical status of infants before the transport leads to better therapeutic outcomes, though if stabilization is not performed properly, it may exacerbate the clinical conditions (Dalal, Vishal & Solanki 2013). The role of medical staff in transporting hospitals is of great importance to determine the infant that should be transported, start the process and stabilize the clinical status of the neonates to be prepared for transport (Karlsen 2003). Hence, it is necessary to equip and train medical staff of maternity hospitals without NICU, in terms of initial medical measures and skills to stabilize the clinical status of neonates for transport (Nakhshab & Vosughi 2010).

Nurses in infants transport team should be trained properly (Nakhshab & Vosughi 2010). To have qualified medical staff, neonatal nurses should be trained in terms of neonatal intensive care practices (Karlsen 2003; Kazemian, Fakhraei & Zonouzi 2004; Martínez Verónica et al. 2011; Khatoni et al. 2011; Thukral et al. 2012; Blakeman & Branson 2013; WHO 2016a). But, training needs enough budget, time and attempts. There are a few teachers who are really qualified in this field. Due to job commitments, nurses have limitations to improve their professional knowledge and participate in educational programs (Thukral et al. 2012). Therefore, it is recommended to employ multimedia methods for in-service training purposes in order to save time and increase the efficacy of education (Babatabar et al. 2013).

It is observed, that the NICU beds are not distributed in Tehran properly (Shafii et al. 2012) and the rate of infant intrahospital transport is high. Also, stabilization of infant's clinical status before transport and continuation of such cares during the transportations are of great importance; however, nurses as the main team members who provide the effective neonatal clinical services should be present at all stages of transport. Therefore, taking critical measures to promote nursing knowledge in terms of stabilization of infants before transport is necessary. Training and education are the knowledge promotion methods. Owing to the advantages of electronic learning (e-learning) in terms of uniformity and standardization of information, extensive and cost-effective training opportunities, lack of e-learning in neonatal stabilization before the transport is highly felt.

2. Materials and Methods

The current quasi-experimental case-control study with pretest-posttest design was conducted on the hospital staff. In order to prevent data exchange between the groups, sampling of intervention and control subjects was performed in different hospitals. For this purpose, the name and information of staff deemed eligible to participate in the study were obtained from the hospital authorities. Based on the number of people eligible for the intervention group in each hospital total six hospitals were allocated into four groups, of which two groups were selected randomly. It was ordained to consider the first draw as the intervention and the second draw as the control group. Hence, the subjects of the intervention group were selected from one group and those of the control group out of two hospitals.

The study population comprised of nurses and midwives taking care of neonates at the hospitals under

study in Obstetrics and Gynecology Departments, labor Unit and NICU in 2015. In the current study, $\alpha = 0.05$ (95% confidence interval), $\beta = 0.2$ (test power 80%); by considering the possible drop-outs, the sample size was set to 45 in each group.

The inclusion criteria were staff holding at least Bachelor's degree, minimum six months of experience in taking care of neonates at the workplace, willingness to participate in training courses, familiarity with computer in order to use the computer-based training system and access to the internet. The exclusion criteria were lack of interest to participate in the study, changing the workplace, participation in neonatal stabilization before transport training courses and not participating in posttests during the current intervention. The authors referred to the hospitals under study for sampling after obtaining the ethical approval from Ethical Committee of Tehran University of Medical Sciences, Tehran, Iran. After providing enough information about the study of eligible subjects, those who were interested in participating in the study were selected using the convenience sampling method. After obtaining the written informed consent and completion of the demographic questionnaire, it was explained to the subjects how to have access to the educational contents, and a username with password was given to each of the subjects. A phone number for close contact was also placed at their disposal.

Data collection tools were a demographic questionnaire including gender, age, level of education and work experience in taking care of neonates, as well as a 30-item researcher-made questionnaire on multiple-choice design to assess the level of knowledge developed after compilation of educational contents. Each item only had one correct answer. The false answers were given zero scores. Hence, the total score of the questionnaire ranged 0-30; higher scores showed more knowledge. The validity of the questionnaire was confirmed by ten experts. The internal consistency was used to evaluate the reliability of the questionnaire. The questionnaire was completed by 22 infants' nurses not included in the study population, and the obtained data were analyzed with SPSS version 18; Cronbach's alpha was > 70%.

The electronic learning syllabuses for neonatal stabilization before transport were determined using experts' comments. The course was called "PIERS strategy" (Procedures, Infection, Equipment, Resuscitation, Support & Safety, Seizure Treatment, Respiratory management, Assessment, Thermoregulation, Empathy, Glucose administration, Yellowish discoloration). The educational contents were evaluated by the faculty members of pediatrics and pediatrics nursing department, and the necessary changes were made. The educational contents and results of knowledge assessment questionnaire were uploaded to lms.darsa.ir and to the Medical Sciences Department of the university, in partnership with one of the industrial universities of Tehran.

Two separate spaces as class groups 1 and 2 were defined in the system. Class group 1 was considered as the intervention and the class group 2 as the control. Each group could have access to its specified account using the assigned username and password. Pretest and posttest questionnaires, time of exams, guidelines to complete and submit the questionnaires were uploaded for both the groups. Educational contents and their usage, guidelines to present the lessons, timetable for educational contents of group 1 were provided in the uploaded pamphlet. The guidelines to access the educational contents were provided in the pamphlet uploaded for group 2. The control group could have access to the basic strategy of educational contents just after submitting the pretest and posttest questionnaire at the predetermined time.

After opening the questionnaire for the first time, the time was displayed on the top of the screen and calculated the completion time of the questionnaire. The participants could open the questionnaire as many times as they wanted, but had only 35 minutes to answer the 30 multiple-choice items. The order of the options was changed by reopening the file and the subjects should reanswer the items. Each participant could only complete and submit the questionnaire once in less than 35 minutes, and after that, the access was restricted. The pretest was held at the same time in two groups.

A week later, the educational contents as texts, images, slides, teaching clips, multimedia, introducing patients, multiple-choice questions, and introducing educational links were gradually placed at the disposal of intervention group within ten days. The contents were weekly given to the learners based on the volume and in the order of the letters of the abbreviated name (PIERS strategy), and they could use the contents at any time based on their needs and interests. The teachers of the training course were two professors and scholars of pediatrics in contact with the learners through news forum, conversation forum, e-mails, short messages, telephone calls, and answered all their questions.

The researcher was in contact with the learners periodically or based on learners' needs and encouraged them to use the educational contents. After ten weeks, the access to educational contents was restricted for two weeks,

and then, the posttest was held. The control group also passed the exam at the same time. The exam was online for the intervention group, but it was both in-person and online for the controls. The pretest and posttest were the same in the two groups. The participants were free to withdraw from the study at any time. To comply with ethical standards, the accessibility to educational contents on basic strategy was utilized for the control group for 10 days.

After saturation of the study sample size, data were collected and then analyzed with SPSS version 18; $P < 0.05$ was considered the level of significance. In order to facilitate the description of the results, the scores obtained from the knowledge questionnaire were categorized (Table 1). To compare pretest and posttest data in each of the groups, paired t test was used. To compare the data from groups, the independent t test was employed. To compare demographic characteristics, the Fisher exact test and the independent t test were used.

3. Results

A total of 52 subjects in the intervention and 50 in the control groups (total 102 eligible nurses and midwives) completed the demographic questionnaire and accordingly entered the current study. In the intervention group, one subject due to the change in the workplace and 11 others due to nonattendance at posttest were excluded; the data from 40 subjects were analyzed. In the control group, two subjects due to change of the workplace and seven others due to nonattendance at posttest were excluded, and data from 41 eligible subjects were analyzed. Approximately, 23.07% of the subjects in the intervention and 18% in the control groups were excluded; the drop-out rate was 41.07% in the current study. All the participants were female, and both groups were matched by age, gender, work experience, and level of education using the tests for homogeneity (the Fisher exact and independent t tests). There was no significant difference between the pretest and posttest scores of the control group in terms of learners' level of knowledge ($P = 0.16$) based on paired t test results; however, the difference was statistically significant in the intervention group ($P < 0.001$). There was also a significant difference between the intervention and control groups comparing the pretest and posttest results using the independent t test ($P < 0.0001$) (Table 2).

Since the groups were not homogenous before intervention in terms of the level of knowledge, pretest and posttest results of the groups were compared in order to evaluate the mean changes in the level of knowledge (Table 3). According to Table 3, the knowledge score of the control group in the test after the intervention decreased, which is not statistically significant. However, the intervention group showed a statistically significant increase in knowledge score in the pretest and posttest comparisons.

4. Discussion

Based on the results of the current study, the mean score of knowledge of neonatal stabilization before the transport was average to good in the nurses of a gynecol-

Table 1. Results of the knowledge assessment questionnaire

Knowledge Score	Interpretation
< 15	Poor
15-20	Average
20-25	Good
25-30	Excellent

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Table 2. Comparison of the mean scores of the knowledge assessment questionnaire between the study groups

Knowledge Group	Mean ± SD		Paired t Test Results
	Pre-intervention	Post-intervention	
Control group (n = 41)	16.02 ± 4.246	15.59 ± 4.237	P = 0.16
Intervention group (n = 40)	20.93 ± 3.785	23.7 ± 3.884	P < 0.001
Independent t test	P < 0.001	P < 0.001	-

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P < 0.05 set to the level of significance.

Table 3. Comparison of pretest and posttest results regarding the mean changes in the level of knowledge between the study groups in terms of neonatal stabilization before transform

		Mean Pretest-Posttest Difference	Test Results		
Level of knowledge	Control	-0.4390	t	df	P
	Intervention	2.7750	6.435	79	0.001

P <0.05 set to the level of significance.

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ogy and labor center as the intervention group (20.93 ± 3.785), while it was poor to average for nurses working in the same departments of public hospitals (16.02 ± 4.246). In a study conducted by Eskandari et al., to evaluate the level of knowledge among NICU nurses about pre-transport caring principles for neonates, the level of knowledge was reported as average (Eskandari 2014). Neonatal stabilization before transport plays a pivotal role in the destiny of the transported neonates. Hence, training the neonatal care providers seems essential.

For this purpose, different plans were designed. In one hand, due to daily advances in the medical sciences, training the healthcare providers and medical settings staff should be continued during their professional life; in other words, utilization is impossible without changing personnel behavior (Sabeghi, Heydari & Borhani 2012). One of the training methods is to hold workshops, but to participate in such workshops, participants should attend a certain place at an exact time. Moreover, these workshops usually face limitations in the number of attendees. In the current study, the principles of neonatal stabilization before transport were trained online in order to diminish such limitations as much as possible. On the other hand, using the information technology and e-learning have numerous advantages such as increased efficacy of the educational process, increased learning quality, facilitated accessibility to a large amount of information in a short time and lower costs (Mahdiyoun et al. 2015).

A study by Babatabar Darzi et al. (2013), showed that employment of virtual learning technologies can enhance the level of learning, active participation and better understanding of theoretic contents for the nurses. Thukral et al. (2012) also reported that the distant online training could promote knowledge and skills in regarding neonatal caring principles among pediatrics nurses. In the current study, educational contents were compiled from reliable databases using experts' comments as basic strategies (abbreviated named PIERS strategy) in order to easily and applicably provide educational contents for the learners. Since in e-learning, the maximum efficacy can be obtained by combining different learning methods such as texts, audios, video, etc. (Ellis, Ginns & Piggott 2009), the educational contents were prepared in different forms and facilities for teacher-student interaction were also provided.

In a study by Sadeghi et al., entitled "Comparison of two methods of electronic learning and lecturing on the level of knowledge in nurses attending the continuous training course at Rafsanjan University of Medical Sciences," it was suggested to use e-learning approaches to implement the educational programs (Sadeghi, Heidari & Bakhshi 2014). Khatooni et al., also indicated in their study that both online and traditional lecturing methods were useful in increasing the level of knowledge among nurses ($P < 0.001$); in addition, both methods had similar efficacy ($P = 0.221$). Results of the current study showed that online facilities can be used similarly to traditional lecturing methods to implement educational programs effectively; applying such programs in further retraining programs was also recommended (Khatoni et al. 2011).

One of the limitations of the current study was the slow speed of the internet to use educational videos; therefore, videos were provided in minimum sizes, and longer videos were divided into several parts to facilitate accessibility. Lack of scheduled, multistep follow-up to evaluate the nurses after the intervention due to limited time, was of the limitations of the current study.

Results of the current study showed that basic strategy of e-learning could significantly improve knowledge of participants in neonatal stabilization before transport. Due to the positive effect of this program on the knowledge level of the learners, it can be expected that the program extensively improve nurses' knowledge in neonatal stabilization before the transport and they benefit from e-learning advantages. It is also expected to reduce side effects and mortality rate in critically ill and premature neonates by improving the level of knowledge among nurses. It is also recommended to extensively use e-learning facilities for the continuous education of medical staff, particularly nurses.

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Conflict of Interest

The authors declared no conflict of interest.

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