



# Effect of Web-Based Education on Knowledge, Attitude, and Practice of Nurses in Neonatal Intensive Care Unit

Parvaneh Zamani<sup>1</sup>, Afsaneh Dehnad <sup>2</sup>, Hamid Haghani <sup>3</sup> and Leili Borimnejad <sup>4,\*</sup>

<sup>1</sup>Neonatal and Pediatric Department, Nursing and Midwifery School, Iran University of Medical Sciences Tehran, Iran

<sup>2</sup>Department of Foreign Languages, Faculty of Management and Medical Information, Iran University of Medical Sciences, Tehran, Iran

<sup>3</sup>Biostatistic Department, Faculty of Health, Iran University of Medical Sciences Tehran, Iran

<sup>4</sup>Nursing Care Research Center, Iran University of Medical Sciences. Tehran, Iran

\*Corresponding author: Ph.D. in Nursing, Professor, Center for Educational Research in Medical Sciences, Iran University of Medical Sciences, Tehran, Iran. Email: borimnejad.l@iums.ac.ir

Received 2018 June 23; Revised 2019 January 24; Accepted 2019 January 27.

## Abstract

**Background:** The neuroprotective interventions are necessary for developing the brain of premature neonates. Neonatal nurses require continuing education about this subject and nowadays distance education is a possibility.

**Objectives:** This study aimed to assess the impact of web-based teaching on knowledge, attitude, and practice of nurses in the neonatal intensive care unit.

**Methods:** This quasi-experimental pre- and post-intervention study with a control group was conducted in 2018. A total number of 70 nurses from selected hospitals affiliated to the Iran University of Medical Sciences were assessed for their knowledge, attitude, and practice in seven neuroprotective core measures prior to the intervention. A four-week standardized training package was implemented in these hospitals through virtual classroom approach. After six weeks of post-intervention, all nurses who attended the virtual training were assessed for the same competencies using the WEE care assessment tool. The reliability of the tool was estimated by calculating the internal consistency of items ( $\alpha = 0.95$ ). The *t* test and repeated measures ANOVA were conducted to analyze the data using SPSS V.16 software.

**Results:** The findings indicated that the mean score of knowledge significantly increased ( $P < 0.001$ ) in the web-based education group ( $21.97 \pm 5.64$ ) compared to the control group ( $13.94 \pm 4.7$ ). However, there was no significant difference between the two groups in the mean scores of attitude and practice.

**Conclusions:** Web-based teaching was found to be effective in improving the knowledge of nurses; however, the results suggest that virtual teaching methods need to be developed to affect the attitude and practice of neonatal nurses.

**Keywords:** Web-Based Education, Knowledge, Neuroprotective Care, Nursing, Neonatal Intensive Care Unit

## 1. Background

Approximately, 15 million infants are born before the end of 37 weeks of gestation in the world every year (1). Ten to fifteen percent of them require being hospitalized in the neonatal intensive care units (NICUs) (2). The advances in the treatment of premature infants have risen the chance of survival in these infants in recent decades (3). Some strong statistical evidence indicates that infants who receive developmental care demonstrate improved behavioral organization and cognitive development until the age of two (4-6). These results are supported by recent systematic reviews (7). The role of the neonatal nurses is vital for the successful implementation of developmental care and the provision of an optimal NICU environment (8). Therefore, it is necessary to enhance nurses' knowl-

edge and skills regarding developmental care and emphasize the need for developmental care (9, 10). In addition, the positive attitude of nursing staff when caring for premature infants and their parents can increase the quality of care and reduce the developmental neurological complications. The level of attitude varies with the knowledge level of nurses (11).

Despite the abundance of continuing education offerings, many nurses do not participate in the programs. A number of barriers have been cited in the literature, including financial considerations, lack of institutional support, time constraints, and family commitments (12). Having access to an open educational environment is essential to ensure lifelong learning for caregivers (13). In addition, new technology plays an important role in facilitating and shortening nursing education. Using computers and In-

tranet is increasing in teaching and learning as an alternative or a complementary way to strengthen the traditional ways of teaching. It seems that the use of these facilities for education improves the quality of education and helps in a comprehensive learning environment, lifelong learning, active learning, and interactive learning (14).

## 2. Objectives

Thus, this study aimed to assess the impact of web-based education on knowledge, attitude, and practice of nurses in the neonatal intensive care unit.

## 3. Methods

This quasi-experimental study was conducted on 70 nurses in hospitals affiliated to the Iran University of Medical Sciences (IUMS). The sample size was calculated based on the following formula:

$$\begin{aligned} n &= \frac{(z_{1-\alpha} + z_{1-\beta})^2 \times (\sigma_1^2 + \sigma_2^2)}{d^2} \\ &= \frac{(1.64^2 + 0.84)^2 (5 + 5^2)}{3^2} \quad (1) \\ &= 34.1 \\ &\cong 35 \end{aligned}$$

; where  $z_{0.975} = 1.64$ ,  $z_{0.8} = 0.84$  and  $d = 3$ .

Using a literature review and based on the mean comparison formula, the sample size, considering a 10% dropout rate, was estimated to be 35 subjects per group. They were allocated randomly to intervention and control groups.

The study obtained ethical approval from the IUMS Ethics Committee. The inclusion criteria included nurses working in a neonatal intensive care unit with at least a bachelor's degree, a minimum of one-year clinical experience in the neonatal intensive care unit, and no participation in the same research program concurrent with the present training.

The exclusion criterion was the absence in the final test. In the beginning, all the participants gave their informed consent. The study used convenience sampling to select NICU nurses who had been enrolled in the program. The pretest questionnaires were completed one-week before the beginning of the intervention.

Data collection tool was a questionnaire based on the Wee Care on knowledge (30 items), attitude (1 items 8), and practice (23 items) (6). The internal reliability of the questionnaire was measured by Cronbach's alpha coefficient of

0.83. For this purpose, first, a health professional, knowledgeable in the English language and familiar with the terminology of the area, translated the questionnaire to Persian. Then, a panel of experts in neonatal care reviewed it and left some comments. Finally, the revised questionnaire was completed by 20 neonatal nurses to calculate the Cronbach's alpha coefficient, giving the values of 0.92 for knowledge, 0.71 for attitude, and 0.88 for practice.

### 3.1. Intervention

An educational program on neuroprotective interventions was implemented in the neonatal units of the selected hospitals in Tehran, Iran, via the learning management system. The educational content was based on the seven neuroprotective core measures depicted as overlapping petals of a lotus as: (1) healing environment, (2) partnering with families, (3) positioning and handling, (4) safeguarding sleep, (5) minimizing stress and pain, (6) protecting skin, and (7) optimizing nutrition (6). A user code was assigned to each nurse. The online page was designed to allow reviewing slides and educational videos at any hour of the day. The program was designed for four weeks. At the end of each week, an online exam was held and each person was allowed to participate in tests three times. At the end of the fourth week, the final test was held once only. After six weeks, knowledge, attitude, and practice of nurses were determined by self-report questionnaires and compared with the results of the pretest.

### 3.2. Data Analysis

Descriptive statistics were used to measure the nurses' knowledge, attitude, and practice levels. Correlation analysis was performed to test the relationships. The analysis of variance (ANOVA) and independent samples *t* test were performed to test the differences.

## 4. Results

All the participants (100%) were female. The majority of them (94.1%) worked in deferent shifts. The two groups were not significantly different in mean years of experience (intervention group:  $9.8 \pm 4.24$  vs. control group:  $8.06 \pm 3.56$ ). The demographic characteristics of the participants are listed in Table 1. Table 2 provides the comparisons of the mean scores of pretest, posttest, and follow-up test. There was a significant difference in the knowledge level between the two groups of nurses after six weeks. The mean posttest scores in all areas were significantly higher than the mean pretest scores ( $P < 0.001$ ). There was no significant difference between the two groups in the mean scores of attitude and practice.

**Table 1.** Demographic Characteristics of Nurses Participated in the Study<sup>a</sup>

	Intervention	Control	P Value
<b>Age, y</b>			0.109
≤ 29	5 (14.3)	5 (14.3)	
30 - 34	12 (34.3)	18 (51.4)	
35 - 39	10 (28.6)	8 (22.9)	
≥ 40	8 (22.9)	4 (11.4)	
<b>Grade</b>			0.198
BSc	30 (85.7)	34 (97.1)	
MSc	5 (14.3)	1 (2.9)	
<b>General internet using, h</b>			0.12
< 1	12 (4.3)	17 (48.6)	
1 - 3	15 (42.9)	7 (20)	
> 3	18 (22.9)	11 (31.4)	

<sup>a</sup> Values are expressed as No. (%).

**Table 2.** The Comparison of Mean Scores (SD) Between Intervention and Control Groups<sup>a</sup>

	Intervention	Control	P Value
<b>Knowledge</b>			
Before	15.65 ± 2	13 ± 4.78	0.06
After	22.51 ± 5.31	13.91 ± 4.47	< 0.001
Follow-up	21.97 ± 5.64	13.94 ± 4.7	< 0.001
Repeated measures ANOVA			
F	34.578	1.927	
P	< 0.001	0.174	
<b>Attitude</b>			
Before	69.24 ± 6.09	68.99 ± 4.26	0.88
After	68.98 ± 10.69	67.93 ± 3.97	0.59
Follow-up	69.69 ± 8.82	68.01 ± 4.46	0.321
Repeated measures ANOVA			
F	1.23	4.418	
P	0.728	0.043	
<b>Practice</b>			
Before	44.06 ± 9.75	53.28 ± 10.14	< .001
Follow-up	44.62 ± 9.7	51.82 ± 10.21	0.335
Paired t test			
t	1.366	0.722	
P	0.181	0.475	

<sup>a</sup> Values are expressed as mean ± SD.

## 5. Discussion

Our results demonstrated the effectiveness of web-based education in increasing knowledge of nurses as

*Interdiscip J Virtual Learn Med Sci. In Press(In Press):e81178.*

found in previous investigations (15). Several studies have shown that web-based educational interventions can improve knowledge of neonatal nurses. In an anonymous evaluation of an online breastfeeding educational program, the authors found a significant change in knowledge and practice of nurses in breastfeeding in NICUs (16).

The results of this study coincide with the findings of a systematic review of six studies by Du et al. to assess the impact of network-based distance education on nurses and nursing students in terms of knowledge enhancement, including preservation knowledge (17). A study conducted by Gerdprasert et al. explicitly showed that the post-test knowledge score was significantly ( $P < 0.001$ ) higher in the intervention group than in the control group (18). Knowledge scores increased significantly from baseline in both groups and no significant differences were detected between the scores of the two groups. The intervention groups had significantly higher scores than the control groups (19, 20).

In addition, in a study by Bloomfield et al. the scores were similar between the two groups. Skill performance scores were similar in both groups at the 2-week follow-up with significant differences emerging at the 8-week follow-up in favour of the intervention group, (21). In a survey by de Góes et al. they believed the inclusion of informatics in nursing teaching is far from being exhausting. It is believed that daily technological advances can contribute to the production of increasingly complex resources directed to nursing education, with rich resources for interaction to bring the final user closer to practical realities (22).

Quantitative studies have investigated the effect of web-based education on nurses' attitude towards neonatal neuroprotection in neonates. There are similar studies with contradictory results compared to the present study. In a study by Cardin et al. in 2015 with the aim of changing the design of NICUs and the attitude of caregivers based on the seven criteria for neurological protection, the neural education course was conducted for 36 months theoretically and practically in workshops and the results were evaluated. It caused a 59% increase in the knowledge of caregivers and their positive attitude toward training and performance, which is consistent with the current research in terms of knowledge gained (23). Benoit and Semenic concluded that training NICU nursing staff could improve knowledge and attitudes (24). Another study in 2015 was conducted in Madrid in NICUs (level 4) after the formation of voluntary groups of nurses and other NICU staff and examining educational needs. Course attendance significantly improved the rate of correct answers (25). Our current results in attitude are different from the findings of some previous studies. We found one study that revealed the web-based education program was not signifi-

cantly effective in nurses' attitude (26).

### 5.1. Research Limitations

The self-assessment of nurses' practice was one of the limitations. Due to the wide scope of training, practice measurement was not possible through observation. In addition, the lack of the same conditions in terms of equipment and training in various hospitals selected to participate in this study may have affected the results, which is another limitation of the study.

### 5.2. Conclusions

The results showed that web-based education increased the knowledge of nurses about neuroprotection of neonates, but in relation to attitude and practice, e-learning alone is not enough and other educational methods should be used to affect these domains. Cultural variables may be a reason for the ineffectiveness of web-based education in attitude and practice in our country. Therefore, future studies are recommended about effective factors in the success of web-based training programs with the ethnographic approach.

### 5.3. Suggestions for Applying the Findings

Web-based e-learning is one of the most important types of e-learning; as one of the phenomena of the modern world in the information age and in the knowledge-based society, it is considerably appreciated despite its short history. Considering the effectiveness of the web-based program in increasing the knowledge of NICU nurses concerning the neuroprotection of premature infants, this type of education can be used as an easy and practical training method for nurses, especially to overcome the constraints of time and place for those who cannot attend regular educational programs. Educational content can also be used to train nurses in NICUs.

### Acknowledgments

The authors of this paper are thankful to Dr. Bahareh Omrani and Hamed Shirazinejad who provided expertise in creating valuable electronic contents that assisted our research project and also professor Altimier provided us questionnaire.

### Footnotes

**Authors' Contribution:** Parvaneh Zamani: Study concept and design and acquisition of data; Afsaneh Dehnad: Critical revision of the manuscript for important intellectual content; Hamid Haghani: Analysis and interpretation of

data, statistical analysis; Leili Borimnejad: Drafting of the manuscript, administrative, technical, and material support and study supervision.

**Conflicts of Interests:** The authors declare that they have no conflicts of interest.

**Ethical Approval:** This study was approved by the Research Ethics Committee with the code IR.IUMS.REC.1395.9211451202. After obtaining permission from the IUMS, the training program began through the learning management system.

**Funding/Support:** This study is a part of an MSc thesis in NICU nursing supported by the research presidency of Iran University of Medical Sciences.

**Patient Consent:** At the beginning of the training program, after the researchers had introduced themselves, written consent was obtained from nurses participating in the study. The nurses were also assured that all information collected would remain confidential.

### References

1. World Health Organization. *Chagas disease (American trypanosomiasis)*. WHO; 2014. Available from: [https://www.who.int/news-room/fact-sheets/detail/chagas-disease-\(american-trypanosomiasis\)](https://www.who.int/news-room/fact-sheets/detail/chagas-disease-(american-trypanosomiasis)).
2. Hamilton BE, Martin JA, Ventura SJ. National vital statistics reports. *Nat Vital Statist Rep*. 2009;57(12).
3. Harijan P, Beer C, Glazebrook C, Israel C, Marlow N, Whitelaw A, et al. Predicting developmental outcomes in very preterm infants: Validity of a neonatal neurobehavioral assessment. *Acta Paediatrica*. 2012;101(7):e275-81.
4. Cong X, Wu J, Vittner D, Xu W, Hussain N, Galvin S, et al. The impact of cumulative pain/stress on neurobehavioral development of preterm infants in the NICU. *Early Hum Dev*. 2017;108:9-16. doi: [10.1016/j.earlhumdev.2017.03.003](https://doi.org/10.1016/j.earlhumdev.2017.03.003). [PubMed: 28343092]. [PubMed Central: PMC5444300].
5. Spittle A, Treyvaud K. The role of early developmental intervention to influence neurobehavioral outcomes of children born preterm. *Semin Perinatol*. 2016;40(8):542-8. doi: [10.1053/j.semperi.2016.09.006](https://doi.org/10.1053/j.semperi.2016.09.006). [PubMed: 27817913].
6. Altimier L, Phillips R. The neonatal integrative developmental care model: Advanced clinical applications of the seven core measures for neuroprotective family-centered developmental care. *Newborn Infant Nurs Rev*. 2016;16(4):230-44. doi: [10.1053/j.nainr.2016.09.030](https://doi.org/10.1053/j.nainr.2016.09.030).
7. Burke S. Systematic review of developmental care interventions in the neonatal intensive care unit since 2006. *J Child Health Care*. 2018;22(2):269-86. doi: [10.1177/1367493517753085](https://doi.org/10.1177/1367493517753085). [PubMed: 29328777].
8. Millette I, Martel MJ, da Silva MR, Coughlin McNeil M. Guidelines for the institutional implementation of developmental neuroprotective care in the NICU. Part B: Recommendations and justification. A joint position statement from the CANN, CAPWHN, NANN, and COINN. *Can J Nurs Res*. 2017;49(2):63-74. doi: [10.1177/0844562117708126](https://doi.org/10.1177/0844562117708126).
9. Rahmah R, Febriana M, Abdullah A. Knowledge and attitude of neonatology nurse towards developmental care. *1st International Conference of Standardized Nursing Language*. 25-26 August 2016; Yogyakarta, Indonesia. 2016.
10. Montanholi LL, Merighi MA, de Jesus MC. [The role of the nurse in the neonatal intensive care unit: Between the ideal, the real and the possible]. *Rev Lat Am Enfermagem*. 2011;19(2):301-8. Portuguese. doi: [10.1590/S0104-11692011000200011](https://doi.org/10.1590/S0104-11692011000200011). [PubMed: 21584376].

11. Polkki T, Korhonen A, Laukkala H, Saarela T, Vehviläinen-Julkunen K, Pietilä AM. Nurses' attitudes and perceptions of pain assessment in neonatal intensive care. *Scand J Caring Sci*. 2010;**24**(1):49–55. doi: [10.1111/j.1471-6712.2008.00683.x](https://doi.org/10.1111/j.1471-6712.2008.00683.x). [PubMed: [20070593](https://pubmed.ncbi.nlm.nih.gov/20070593/)].
12. Witt CL. Continuing education: A personal responsibility. *Adv Neonatal Care*. 2011;**11**(4):227–8. doi: [10.1097/ANC.0b013e31822648f3](https://doi.org/10.1097/ANC.0b013e31822648f3). [PubMed: [22123340](https://pubmed.ncbi.nlm.nih.gov/22123340/)].
13. Lahti M, Hatonen H, Valimäki M. Impact of e-learning on nurses' and student nurses knowledge, skills, and satisfaction: A systematic review and meta-analysis. *Int J Nurs Stud*. 2014;**51**(1):136–49. doi: [10.1016/j.ijnurstu.2012.12.017](https://doi.org/10.1016/j.ijnurstu.2012.12.017). [PubMed: [23384695](https://pubmed.ncbi.nlm.nih.gov/23384695/)].
14. Zandi S, Abedi D, Changiz T, Yousefi A, Yamani N, Kabiri P. [Electronic learning as a new educational technology and its integration in medical education curricula]. *Iran J Med Educ*. 2004;**4**(1):61–70. Persian.
15. Tornava M, Koivula M, Helminen M, Suominen T. Web-based education about vulvodynia and its care among student healthcare staff: A quasi-experimental study. *Nurse Educ Pract*. 2018;**31**:194–9. doi: [10.1016/j.nepr.2018.06.008](https://doi.org/10.1016/j.nepr.2018.06.008). [PubMed: [29986313](https://pubmed.ncbi.nlm.nih.gov/29986313/)].
16. Deloian BJ, Lewin LO, O'Connor ME. Use of a web-based education program improves nurses' knowledge of breastfeeding. *J Obstet Gynecol Neonatal Nurs*. 2015;**44**(1):77–86. doi: [10.1111/1552-6909.12534](https://doi.org/10.1111/1552-6909.12534). [PubMed: [25580851](https://pubmed.ncbi.nlm.nih.gov/25580851/)].
17. Du S, Liu Z, Liu S, Yin H, Xu G, Zhang H, et al. Web-based distance learning for nurse education: A systematic review. *Int Nurs Rev*. 2013;**60**(2):167–77. doi: [10.1111/inr.12015](https://doi.org/10.1111/inr.12015). [PubMed: [23691999](https://pubmed.ncbi.nlm.nih.gov/23691999/)].
18. Gerdprasert S, Pruksacheva T, Panijpan B, Ruenwongsa P. Development of a web-based learning medium on mechanism of labour for nursing students. *Nurse Educ Today*. 2010;**30**(5):464–9. doi: [10.1016/j.nedt.2009.10.007](https://doi.org/10.1016/j.nedt.2009.10.007). [PubMed: [19931950](https://pubmed.ncbi.nlm.nih.gov/19931950/)].
19. Lu DF, Lin ZC, Li YJ. Effects of a web-based course on nursing skills and knowledge learning. *J Nurs Educ*. 2009;**48**(2):70–7. doi: [10.3928/01484834-20090201-10](https://doi.org/10.3928/01484834-20090201-10). [PubMed: [19260398](https://pubmed.ncbi.nlm.nih.gov/19260398/)].
20. Chiu DKW, Marenzi I, Nanni U, Spaniol M, Temperini M. Advances in Web-Based Learning – ICWL 2016. *Lecture Notes in Computer Science*. Springer; 2016. doi: [10.1007/978-3-319-47440-3](https://doi.org/10.1007/978-3-319-47440-3).
21. Bloomfield J, Roberts J, While A. The effect of computer-assisted learning versus conventional teaching methods on the acquisition and retention of handwashing theory and skills in pre-qualification nursing students: A randomised controlled trial. *Int J Nurs Stud*. 2010;**47**(3):287–94. doi: [10.1016/j.ijnurstu.2009.08.003](https://doi.org/10.1016/j.ijnurstu.2009.08.003). [PubMed: [19762016](https://pubmed.ncbi.nlm.nih.gov/19762016/)].
22. Góes FSN, Fonseca LMM, Leite AM, Furtado MCC, Scochi CGS. Development and evaluation of an interactive virtual learning object on the diagnostic reasoning in nursing applied to preterm newborns. *Soc Behav Sci*. 2012;**46**:617–23. doi: [10.1016/j.sbspro.2012.05.173](https://doi.org/10.1016/j.sbspro.2012.05.173).
23. Cardin AD, Rens L, Stewart S, Danner-Bowman K, McCarley R, Kopsas R. Neuroprotective core measures 1–7: A developmental care journey: Transformations in NICU design and caregiving attitudes. *Newborn Infant Nurs Rev*. 2015;**15**(3):132–41. doi: [10.1053/j.nainr.2015.06.007](https://doi.org/10.1053/j.nainr.2015.06.007).
24. Benoit B, Semenic S. Barriers and facilitators to implementing the baby-friendly hospital initiative in neonatal intensive care units. *J Obstet Gynecol Neonatal Nurs*. 2014;**43**(5):614–24. doi: [10.1111/1552-6909.12479](https://doi.org/10.1111/1552-6909.12479). [PubMed: [25143255](https://pubmed.ncbi.nlm.nih.gov/25143255/)].
25. Mosqueda-Pena R, Lora-Pablos D, Pavon-Munoz A, Ureta-Velasco N, Moral-Pumarega MT, Pallas-Alonso CR. Impact of a developmental care training course on the knowledge and satisfaction of health care professionals in neonatal units: A multicenter study. *Pediatr Neonatol*. 2016;**57**(2):97–104. doi: [10.1016/j.pedneo.2015.04.010](https://doi.org/10.1016/j.pedneo.2015.04.010). [PubMed: [26205438](https://pubmed.ncbi.nlm.nih.gov/26205438/)].
26. Lea P. The effect of educational intervention on nurses' attitudes and beliefs about depression in heart failure patients. *Depress Res Treat*. 2014;**2014**:257658. doi: [10.1155/2014/257658](https://doi.org/10.1155/2014/257658). [PubMed: [25525516](https://pubmed.ncbi.nlm.nih.gov/25525516/)]. [PubMed Central: [PMC4265535](https://pubmed.ncbi.nlm.nih.gov/PMC4265535/)].