

Original Article

Comparing the Effects of Face-to-Face and Video-Based Educations on Hand Hygiene Knowledge and Performance among Mothers in Neonatal Intensive Care Unit: A Randomized Controlled Trial

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ABSTRACT

Background: Hand hygiene is the first step in nosocomial infection control. However, most people have limited knowledge about proper hand hygiene. **Objectives:** This study aimed at comparing the effects of face-to-face education (FTFE) and video-based education (VBE) on hand hygiene knowledge and performance among mothers in neonatal intensive care unit (NICU). **Methods:** Using a three-group design, this randomized controlled trial was conducted in March–December 2019 in Al-Zahra University Hospital, Tabriz, Iran. In total, 132 mothers of neonates in NICU were recruited to the study through convenient sampling and were randomly allocated to either an FTFE group, a VBE group, or a control group. Data were collected before and 3 days after the intervention using a Maternal Hand Hygiene Knowledge Questionnaire and a Maternal Hand Hygiene Performance checklist. Data analysis was performed using the Chi-square test, paired-samples *t*-test, one-way analysis of variance, and analysis of covariance. **Results:** The mean scores of hand hygiene knowledge and performance significantly increased in both the intervention groups ($P < 0.05$) but did not significantly change in the control group ($P > 0.05$). There were no significant differences among the groups regarding the pretest mean scores of hand hygiene knowledge ($P = 0.24$) and performance ($P = 0.26$), while the posttest mean scores of hand hygiene knowledge and performance in both the intervention groups were significantly greater than the control group ($P < 0.05$). **Conclusion:** Both FTFE and VBE are effective in significantly improving hand hygiene knowledge and performance among the mothers of neonates in NICU.

KEYWORDS: Education, Hand hygiene, Knowledge, Neonatal intensive care unit, Performance

INTRODUCTION

Nosocomial infections are among of the major health challenges throughout the world. By definition, nosocomial infections are infections acquired due to stay in hospitals or other health-care settings.^[1] Estimates show that 7 out of every one hundred hospitalized

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patients in developed countries and 15 out of every one hundred hospitalized patients in low- and middle-income countries develop at least one nosocomial infection.^[2] The burden and the risk of nosocomial infections are significantly higher among high-risk patients such as those in intensive care unit (ICU), particularly neonates in neonatal intensive care unit (NICU).^[3] In NICU, neonates usually have prolonged hospital stay and immature immune system and hence are more prone to nosocomial infections.^[4]

One of the main routes of infection transmission in health-care settings is through hands.^[5,6] Therefore, the World Health Organization and the Centers for Disease Control and Prevention recommend hand hygiene as the first, simplest, and most cost-effective technique for infection control.^[7] Health-care providers, patients, and their family members in health-care settings need to closely adhere to hand hygiene guidelines in order to prevent and minimize nosocomial infections.

Currently, NICU policies encourage parents' active involvement in care delivery to their neonates in NICU.^[8] Thereby, they can play a critical role in nosocomial infection prevention through their close adherence to hand hygiene guidelines.^[9,10] However, evidence shows that health-care providers and patients' family members in health-care settings have limited adherence to these guidelines,^[11,12] and hence, poor hand hygiene is currently a major challenge in health-care settings.^[13]

A significant factor contributing to poor adherence to hand hygiene guidelines and nosocomial infection transmission through hands is lack of knowledge about hand hygiene techniques among patients' family members.^[14] Therefore, providing them with education can improve their hand hygiene practice and reduce the risk of nosocomial infections.^[15,16] Active involvement of mothers in the process of care delivery to their neonates in NICU also highlights the importance of providing them with quality education about hand hygiene in order to minimize the risk of nosocomial infections.^[17]

There are various direct and indirect methods for providing patient and family education. The advantages of indirect methods such as video-based education (VBE) include the possibility of providing education with limited costs and limited number of staff and the possibility of sending quick educational messages to a large number of people.^[18] The use of VBE helps learners acquire better understanding about abstract and unfamiliar concepts.^[19] The most important direct method for patient and family education is face-to-face education (FTFE). In this method, instructors can provide learners with opportunities to actively engage

in learning in real situations, ask their questions, discuss their concerns, independently manage their conditions, and correct their health-related misconceptions.^[20]

Previous studies into the effects of education on hand hygiene were mostly on health-care providers,^[21,22] and there are little data about the effects of education on hand hygiene among family members.^[23] Therefore, this study was conducted to fill this gap.

Objectives

The aim of this study was to compare the effects of FTFE and VBE on hand hygiene knowledge and performance among mothers in NICU.

METHODS

Design and participants

This randomized controlled trial was conducted in March–December 2019 in Al-Zahra University Hospital, Tabriz, Iran, using a three-group design. Participants were 132 mothers of neonates in NICU who were recruited to the study through convenient sampling. Inclusion criteria were having a newly admitted neonate in NICU with an NICU stay of <1 day, active involvement in care delivery to the neonate, agreement for participation, no wounds or problems in hands, no sensory problem, no work experience as health-care provider, basic literacy skills, and no experience of hand hygiene education. Exclusion criteria were voluntary withdrawal from the study and neonatal death or discharge from NICU during the first 3 days of NICU stay.

Sample size was calculated using the formula for the comparison of two means and the results of a pilot study into the effects of FTFE on hand hygiene knowledge among 30 eligible mothers. With a confidence level of 0.95, a power of 0.90, a μ_1 of 1.37, a μ_2 of 0.77, an S_1 of 0.89, and an S_2 of 0.72, sample size was determined to be forty per group. Considering possible dropout rate, the sample size increased to 44 mothers per group (132 in total).

Eligible participants were randomly allocated to either an FTFE group, a VBE group, or a control group through the block randomization method with block size of three. The allocation sequence was generated by the statistical advisor of the study and using an online randomization service (www.randomization.com). The first author allocated participants to the groups using the generated allocation sequence. To conceal the allocation sequence, the numbers generated for random allocation were provided to the first author one by one.

Instruments

Data collection instruments were a maternal and neonatal demographic characteristic questionnaire, a researcher-made Maternal Hand Hygiene Knowledge Questionnaire, and a researcher-made Maternal Hand Hygiene Performance checklist.

The demographic characteristic questionnaire included items on participants' age, education level, employment status, number of deliveries, type of the last delivery, and number of daily involvements in neonatal care, as well as items on neonate's gender, gestational age, and birth weight.

The researcher-made, ten-item Maternal Hand Hygiene Knowledge Questionnaire was developed through reviewing the existing hand hygiene guidelines and literature and seeking comments from several NICU nurses and a hospital infection control supervisor. It contained multiple-choice items on hand hygiene (five items) and nosocomial infections (five items). Wrong and right answers were, respectively, scored 0 and 1. The possible total score of this questionnaire was 0–10 with higher scores showing greater hand hygiene knowledge.

The researcher-made Maternal Hand Hygiene Performance checklist was developed based on the World Health Organization Guidelines on Hand Hygiene in Health Care.^[24] It contained 14 items on the steps of hand hygiene. Accurate performance of each step was scored 1 and its inaccurate performance was scored 0. The possible total score of the checklist was 0–14 with higher scores showing better hand hygiene performance. Participants' hand hygiene performance was evaluated by a research assistant who was an NICU nurse from the study setting.

The face validity and the content validity of the study instruments were confirmed by ten instructors from the Schools of Nursing ($n = 7$) and Medicine ($n = 3$) of Tabriz University of Medical Sciences, Tabriz, Iran. The reliability of the knowledge and the performance questionnaires was assessed through internal consistency assessment, in which 45 mothers (in the pilot study) completed the instruments and the total Cronbach's alpha of the instruments was calculated to be 0.85. Moreover, for inter-rater reliability assessment, two raters independently and simultaneously evaluated hand hygiene performance of 15 mothers and the Cohen's kappa agreement coefficient was calculated to be 0.80.

Intervention

Initially, participants were asked to complete the maternal demographic characteristic questionnaire and the knowledge questionnaire through the self-report method in the presence of the first author. Data on

neonates' demographic characteristics were collected through their medical records. Then, participants washed their hands before entering NICU while the research assistant evaluated their hand hygiene performance using the hand hygiene performance checklist. After that, participants in the FTFE group received 4-min education about hand hygiene from the first author, while their counterparts in the VBE group individually watched a 4-min video related to hand hygiene. The video had specifically been developed for the purpose of the present study and showed one of the authors of the study implementing and describing hand hygiene techniques. FTFE and VBE were almost the same in content and duration. Educational materials were developed based on the World Health Organization Guidelines on Hand Hygiene in Health Care and were approved by ten instructors from the Schools of Nursing ($n = 7$) and Medicine ($n = 3$) of Tabriz University of Medical Sciences, Tabriz, Iran. Participants in the control group did not receive any organized education about hand hygiene. Three days after the intervention, participants' hand hygiene knowledge and performance were re-assessed in all the three groups. After the posttest, FTFE about hand hygiene was provided to participants in the control group and the hand hygiene video was presented to the authorities of the study setting.

Ethical considerations

The Ethics Committee of Tabriz University of Medical Sciences, Tabriz, Iran, approved this study (code: IR.TBZMED.REC.1397.276). Then, the study was registered in the Iranian Registry of Clinical Trials (code: IRCT20181207008315N29). Study aim was explained to participants and they were ensured of the confidentiality of the data, the voluntariness of participation in the study, and their freedom to withdraw from the study at will. Written informed consent was obtained from each participant.

Data analysis

The data were analyzed using the SPSS software v. 21.0 (SPSS Inc., Chicago, IL, USA). Categorical variables were described through absolute and relative frequencies, while numerical variables were described through mean and standard deviation. The Kolmogorov–Smirnov test was performed to test the normality of the variables which revealed that all data had normal distribution. Between-group comparisons regarding participants' characteristics were made using the Chi-square test and the one-way analysis of variance. Within-group comparisons regarding the mean scores of hand hygiene knowledge and performance were also made through the paired-samples *t*-test. Moreover, the analysis of covariance with the Sidak *post hoc* method was used for

between-group comparisons respecting the posttest mean scores of hand hygiene knowledge and performance. $P < 0.05$ was considered statistically significant.

RESULTS

All 132 participating mothers completed the study [Figure 1]. Most participants had given birth through cesarean section (79.5%), were primiparous (56.8%), had high school diploma or below-diploma education (79.5), and were homemaker (76.5%). Around 41.7% of the participants involved in neonatal care 4–6 times a day. Groups did not significantly differ from each other regarding participants' and their neonates' characteristics [$P > 0.05$; Table 1].

There were no significant differences among the groups regarding the pretest mean scores of hand hygiene knowledge ($P = 0.24$) and performance ($P = 0.26$). The mean scores of hand hygiene knowledge and performance significantly increased in both the intervention groups ($P < 0.05$) but did not significantly change in the control group during the study [$P > 0.05$; Table 2].

The results of the analysis of covariance showed that after adjusting the effects of education level, employment status, age, and pretest values of knowledge or performance, there were significant differences among the groups regarding the posttest mean scores of hand hygiene knowledge and performance ($P < 0.05$). Pairwise comparisons revealed that the posttest mean scores of hand hygiene knowledge and performance in both the intervention groups were significantly greater than the control group ($P < 0.05$). Moreover,

the posttest mean score of hand hygiene performance in the FTFE group was significantly greater than the VBE group ($P < 0.001$), while there was no significant difference between the intervention groups regarding the posttest mean score of hand hygiene knowledge [$P = 0.248$; Table 3].

DISCUSSION

This study showed that both FTFE and VBE significantly improved the mean scores of hand hygiene knowledge and performance among the mothers of neonates in NICU. In agreement with these findings, a previous study showed that education was effective in significantly improving hand hygiene knowledge among children and their visitors.^[25] A number of earlier studies also reported that both multimedia education and FTFE had positive effects on knowledge and performance among pregnant women^[26] and patients who used inhaler devices.^[27] These findings highlight the importance of education, through either FTFE or VBE, for improving hand hygiene knowledge and performance among mothers in hospital settings. As neither FTFE nor VBE is associated with serious adverse effects, they can safely be used for improving hand hygiene knowledge and performance in NICU and other health-care settings.

In the present study, FTFE significantly improved hand hygiene knowledge and performance. Moreover, findings showed that compared with VBE, FTFE was more effective in significantly improving hand hygiene performance. In line with these findings, a previous study found that FTFE significantly improved knowledge, attitude,

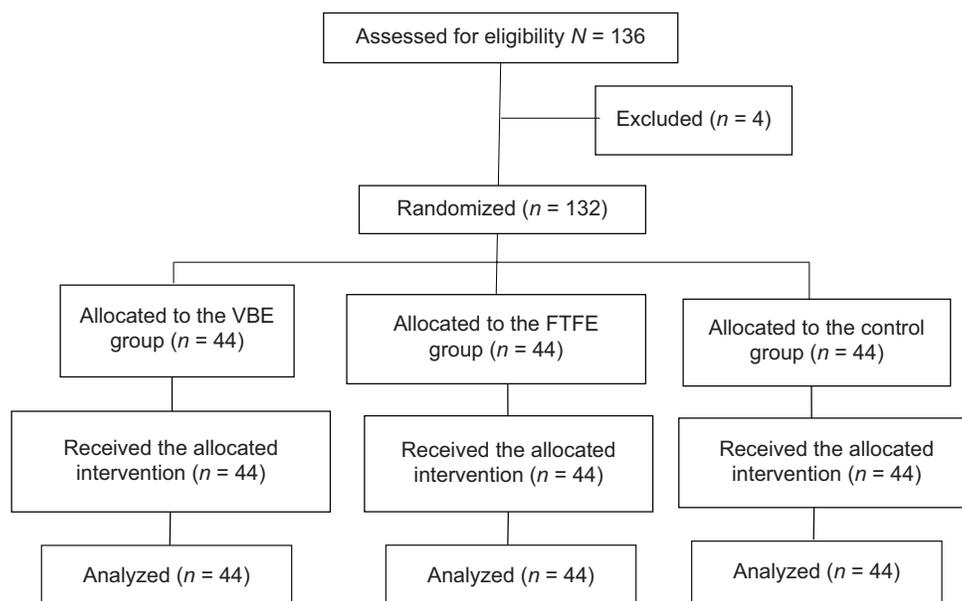


Figure 1: The flow diagram of the study

Table 1: Among-group comparisons regarding participants' characteristics

Characteristics	Group, n (%) or mean ± SD			P
	FTFE	VBE	Control	
Type of delivery				0.40 ^a
Normal	11 (25.0)	6 (13.6)	10 (22.7)	
Cesarean section	33 (75.0)	38 (86.4)	34 (77.3)	
Number of deliveries				0.24 ^a
1	26 (59.09)	25 (56.8)	24 (54.55)	
2	14 (31.82)	12 (27.3)	16 (36.36)	
3 or more	4 (9.09)	7 (15.9)	4 (9.09)	
Educational level				0.45 ^a
University	8 (18.2)	12 (27.3)	7 (15.9)	
Diploma or lower	36 (81.8)	32 (72.7)	37 (84.1)	
Employment status				0.15 ^a
Employed	8 (18.2)	10 (22.7)	13 (29.5)	
Homemaker	36 (81.8)	34 (77.3)	31 (70.5)	
Infant's gender				0.30 ^a
Male	22 (50.0)	23 (52.3)	26 (59.1)	
Female	22 (50.0)	21 (47.7)	18 (40.9)	
Gestational age at birth (weeks)				0.27 ^a
<30	21 (47.7)	17 (38.6)	19 (43.2)	
30–34	15 (34.1)	21 (47.8)	17 (38.6)	
>34	8 (18.2)	6 (13.6)	8 (18.2)	
Number of daily involvements in care				0.34 ^a
1–3	13 (29.5)	10 (22.7)	14 (31.8)	
4–6	16 (36.4)	22 (50.0)	17 (38.6)	
7–9	6 (13.6)	8 (18.2)	9 (20.5)	
>10	9 (20.5)	4 (9.1)	4 (9.1)	
Maternal age (years)	27.72 ± 7.02	31.34 ± 8.68	29.28 ± 6.87	0.86 ^b
Birth weight (g)	1883.27 ± 1548.62	1616.36 ± 703.0	1659.15 ± 892.36	0.48 ^b

^aThe results of the Chi-square test; ^bThe results of the one-way analysis of variance. SD: Standard deviation, FTFE: Face-to-face education, VBE: Video-based education

Table 2: Within-group comparisons regarding the mean scores of hand hygiene knowledge and performance

Variable/ group	Time		Mean differences	P ^a
	Before	After		
Knowledge				
FTFE	3.00 ± 1.85	9.32 ± 1.24	6.72 ± 13.97	<0.001
VBE	2.54 ± 1.59	8.51 ± 1.26	5.65 ± 2.91	0.001
Control	2.48 ± 1.12	2.81 ± 1.23	0.24 ± 1.15	0.16
Performance				
FTFE	47.01 ± 10.59	90.23 ± 1.55	43.35 ± 15.53	<0.001
VBE	44.31 ± 8.79	78.79 ± 1.52	34.41 ± 13.62	<0.001
Control	44.12 ± 8.09	46.89 ± 1.51	2.69 ± 10.01	0.07

^aThe results of the paired-samples *t*-test. FTFE: Face-to-face education, VBE: Video-based education

and performance regarding the disinfection of surgical instruments among operating room staff.^[28] Two other studies also showed that FTFE was effective in significantly improving mothers' knowledge and performance regarding breastfeeding.^[29,30] The significant effects of FTFE on hand hygiene knowledge and performance and its greater effects than VBE on hand hygiene performance are attributable

to the closer relationships between instructors and learners in FTFE which result in learners' greater attention to the provided education and the greater opportunity for learners to ask their questions, receive feedback, and clarify their ambiguities. However, FTFE is not always possible due to factors such as nurses' heavy workload, their limited time for patient education, mothers' limited physical and mental readiness for learning in hospital settings, NICU overcrowding, and lack of appropriate places for education in hospital settings.

Study findings also showed that VBE was effective in significantly improving hand hygiene knowledge and performance. In agreement with this finding, a study found that VBE improved adherence to hand hygiene guidelines among the family members of children in ICU.^[31] Another study reported the positive effects of VBE on knowledge and performance regarding behavioral problems among preschool children.^[32] Similarly, two studies showed that multimedia education improved parents' knowledge about care delivery to children with asthma^[33] and children with colostomy.^[34]

Table 3: Among-group comparisons regarding the posttest mean scores of hand hygiene knowledge and performance

Variable	I group/J group	Characteristics			P ^a
		Mean difference (I–J)	95% CI		
			Lower bound	Upper bound	
Knowledge	FTFE (mean: 8.35)				
	VBE	–2.096	–5.673	1.481	0.248
	Control	5.507	1.953	9.061	0.003
	VBE (mean: 10.44)				
	FTFE	2.096	–1.481	5.673	0.248
	Control	7.603	4.082	11.123	<0.001
Performance	Control (mean: 2.84)				
	FTFE	–5.507	–9.061	–1.953	0.003
	VBE	–7.603	–11.123	–4.082	<0.001
	FTFE (mean: 89.52)				
	VBE	10.309	5.979	14.640	<0.001
	Control	42.376	38.117	46.635	<0.001
Performance	VBE (mean: 79.21)				
	FTFE	–10.309	–14.640	–5.979	<0.001
	Control	32.067	27.848	36.286	<0.001
	Control (mean: 47.15)				
	FTFE	–42.376	–46.635	–38.117	<0.001
	VBE	–32.067	–36.286	–27.848	<0.001

^aThe results of the one-way analysis of variance. FTFE: Face-to-face education, VBE: Video-based education, CI: Confidence interval

Recent advances in multimedia technology have provided greater opportunities for the use of VBE in patient education. VBE has many advantages including simplicity of use, cost-effectiveness, the possibility of saving educational materials for multiple uses, and the possibility of maintaining the continuity of education. The lower effectiveness of VBE than FTFE in the present study may be due to the lack of face-to-face interaction between instructor and learners in VBE.

The main strength of this study was its randomized controlled design. Nevertheless, this study had some limitations. For example, its sample only consisted of mothers in NICU. Further studies are needed to evaluate and compare the effects of different patient education methods on hand hygiene knowledge and performance among patients and family members in health-care settings.

CONCLUSION

This study concludes that both FTFE and VBE have significant positive effects on hand hygiene knowledge and performance among the mothers of neonates in NICU. Moreover, FTFE is more effective than VBE in significantly improving hand hygiene performance. Therefore, nurses can use these interventions to improve hand hygiene knowledge and performance among the mothers of neonates in NICU and thereby reduce the risk of nosocomial infections in health-care settings. Education about hand hygiene should routinely be provided to all mothers in NICU. The selection of either of the FTFE or VBE method for patient education should be based

on the immediate environmental conditions, learners' characteristics, and available equipment.

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Conflicts of interest

There are no conflicts of interest.

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