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EFFECT OF IMPLEMENTING AN EDUCATIONAL PROGRAM ABOUT FAMILY CENTERED DEVELOPMENTAL CARE ON NEONATAL NURSES' KNOWLEDGE AND PRACTICES AT NEONATAL INTENSIVE CARE UNITS

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Abstract:

Background: Preterm infant is a live born infant delivered before 37 completed weeks of gestation. Prematurity is responsible for the largest number of admissions to neonatal intensive care unit (NICU). Family centered developmental care (FCDC), is **defined** as a group of nursing interventions formulated to reduce the effects of the NICU environmental stressors on preterm infants, and integration of family in their infants' care in order to improve outcomes of preterm infants, and their families. Neonatal nurses are in a unique position to implement neuroprotective interventions. **Aim of the study** this study was done to evaluate the effect of implementing an educational program about FCDC on neonatal nurses' knowledge and practice. **Design:** A quasi experimental research design using (pre-test & post-test measures) was used. **Method:** The study was conducted at the NICUs related to El-Mansoura General Hospital and El-Mansoura New General Hospital at Mansoura City, Egypt. The study included all nurses (=51), recruited over six months' period. Two tools were used to collect data; nurses' knowledge about family centered developmental care structured questionnaire, and nurses' practices of family centered developmental care observational checklist. **Results:** The finding of this study showed that, the minority of nurses (13.7%) had sufficient knowledge about FCDC before the program implementation, the percentage was improved to 100% immediately after the program, and at follow up In addition, the FCDC program implementation resulted in significant improvements in nurses' practices from totally unsatisfactory before the program implementation to 100 % satisfactory immediately after and slightly declined to 95.7% at follow up phase and the difference was statistically significant at p=0. 000. **Conclusion & recommendations:** it was concluded that the educational program has positive effect on nurses' knowledge and practice regarding FCDC. The study recommended including FCDC interventions into nurses' curriculum and creates developmental care team with physicians, and nurses to follow the application of family centered developmental care. As well as assessing mothers' barriers that hindering them from being a part of their preterm infant life at NICU. In addition, continuous training is essential to change the attitude of medical team toward including family in care plan for the preterm infants.

Key words: Preterm infant, Developmental care, Family centered care, Neonatal nurses

Introduction:

The birth of pre term infant is the leading cause of an estimated 35% of neonatal deaths worldwide (1) and the second cause of death after pneumonia in children under five years (2). In Egypt, preterm birth represents approximately 10

% of total live births [3]. Moreover, preterm birth complications comprising about 28.5% of all Egyptian deaths in children less than 5 years. Egypt ranked as 144 worst on the list of 162 countries with prematurity related deaths [4]. Specifically, the incidence of preterm birth is account for about one quarter (24.3%) of total deliveries in Mansoura University Hospital, Mansoura city [5].

Prematurity is the most important cause of NICU admission, while preterm infants lack capability to survive outside the uterus due to their physiological and developmental immaturity [6]. Unfortunately, transition of the preterm infant from the womb to the stressful environment of the NICU can deprived preterm infant from basic developmental needs and can permanently alter his normal brain development [7].

Family centered developmental care (FCDC) is a broad term applied to a range of evidence - based nursing interventions designed to decrease exposure to stress in the NICU, allow optimal neurobehavioral development of the infant, standardizing care giving practices and optimize the NICU environment in order to facilitate the best outcomes for premature infants and their families [8]. Three quarters of preterm infants could be saved with these, cost effective interventions, even without intensive care facilities [9].

Evidences support that preterm who receive FCDC have demonstrated a variety of positive outcomes including improved growth, decreased days on ventilators, decreased severity of lung disease, enhanced breastfeeding outcomes, fewer medical complications, shorter lengths of hospital stay, as well as decreased hospital costs, reduced parental stress, increased parental confidence after discharge, fewer readmissions [10]. In addition, increased staff satisfaction has documented when neuroprotective education and subsequent change of care practices were implemented [11].

The main barriers confronting FCDC implementation in the NICUs is the absence of protocols, insufficient staff education, and lack of coordination between professionals at the unit [12, 13]. So, this study was done to evaluate the effect of implementing training program about family centered developmental care on neonatal nurses' knowledge and practices about FCDC at NICU.

Research hypothesis:

Nurses would have better knowledge and practice about family centered developmental care after educational program implementation than before its implementation.

Materials and Methods

I- Materials:

Design:

A quasi-experimental research design was utilized in this study.

Setting:

This study was carried out at the NICUs related to El-Mansoura General Hospital and El-Mansoura New General Hospital at Mansoura City, Egypt.

Subjects:

The subjects of the study included all available nurses (51) working at the above mentioned study settings regardless of their age and qualification or years of experience.

Tools:

Tool 1: Nurses' knowledge about FCDC structured questionnaire. This tool was used to assess nurses' knowledge about family centered developmental care. Questions were in the form of multiple choice questions and open & close-ended questions. It included two parts as the following:

Part I: characteristics' of studied nurses including: age, level of education, years of

experience and previous attendance of workshops and/ or conferences related to family centered developmental care for preterm infants.

Part II*:* **It included 29 questions covered definition, components, importance, and barriers facing family centered developmental care application.**

Tool II: Nurses' practices of family centered developmental care observational checklist. This tool was used to assess actual nurses' practices of FCDC. The checklist consisted of (18) questions figuring out actual nurses' performance of FCDC components such as; positioning (nesting / swaddling), gentle touch and kangarooing, application of pain management measures, encourage breast feeding and /or breast milk expression, controlling the NICU environment related to noise and light, and involving mothers in their preterm care.

The educational program about family centered developmental care for neonatal nurses at NICUs.

The investigator designed the program based on the actual need assessment of the studied nurses and reviewing the related literature.

Goals of the educational sessions:

The general objective of the educational sessions was:

At the end of the educational sessions, nurses were expected to acquire knowledge and practices regarding to family centered developmental care as an evidence-based type of care for preterm infants.

The specific objectives of the educational sessions were:

1. Define the FCDC.
2. Discuss the basic components of FCDC
3. Describe importance of FCDC.
4. Apply FCDC components at clinical practices.
5. Enumerate barriers confronting FCDC application.

The program contained theoretical and practical skills related to FCDC aiming to improve nurses' knowledge and practices of family centered developmental care at NICUs.

The program was implemented in the NICU where the nurses are grouped in small groups; (3- 4 in each group). It was given in four sessions; three theoretical and one practical session. The time of each session was 30- 45 minutes. The program was given over a period of 12 weeks. Different method of teaching was used in the form of lectures, group discussion, demonstration and re-demonstrations. The educational program was presented in different way in the form of colored posters, power point, video and hand out. The program was carried out in the neonatal Intensive Care Unit.

Indications for program success

- Improvements in the nurses' knowledge about FCDC as evaluated through posttest.
- Improvements in the nurses' practices of FCDC as evaluated by the researcher observations post program implementation.

Method:

An official permission was obtained by submission of an official letter to the director of the hospital and the head of neonatal Intensive Care Unit to conduct the study after explaining the aim of the study. The first tool was adopted by the researcher and the second tool was developed by the researcher, after reviewing of the related literature. The tools were tested for reliability by measuring the internal consistency of its items using the Alpha Cronbach's coefficient. The alpha reliability for tool (1) was (0.78) and tool (2) was (0.93).

A pilot study was carried out on 5 nurses (10% of the total sample size), to

ascertain the feasibility, applicability and clarity of the tools. No modifications were done on the tools. Therefore, the subjects included in the pilot study were included in the study samples.

Data collection of this study was carried out over six months in the period from the first of June 2015 to the end of November 2015.

Ethical Considerations

Approval was obtained from Research Ethics Committee at the Faculty of Nursing - Mansoura University. Oral approval was obtained from every nurse after explaining the aim of the study. Confidentiality of data as well as nurses' right to withdraw from the study at any time was ascertained.

Analysis of Data

The data were coded and entered in a data based file using the Statistical Package of Social Sciences (SPSS) version 22. Descriptive statistics (number, percentage, mean & SD) were used to describe the main variable. The Chi square test was used for comparison between groups as appropriate. Use wilcoxon signed rank test (Z value) to compare relation between the two groups. All tests were performed at the level of significance "P-value" equal or less than 0.05 was considered statistically significant.

Results:

It was observed from **table (1)** that, more than half of the nurses (54.9%) were in the age group 20 to 25 years old while, slightly less than two thirds of the nurses (64.7%) had university graduations, more than two fifth of the nurses (43.2%) spend between one and five years experiences working at NICU. In addition, all (100%) of the studied nurses didn't attend any training program about FCDC.

Table **(2)**, clearly revealed that, 43.2% of the studied nurses stated that, they did not know neither the definition nor the components of FCDC, as well as, 49% of them did not know the principles of FCDC preprogram intervention, compared with all (100) of them, who reported the correct answers immediately after implementation of the study program and at follow up, with a very highly statistically significant differences at p=0. 000.

In relation to nurses' knowledge about the benefits and the barriers confronting FCDC application at NICU, the same table demonstrated that pre the intervention program phase, 47%, and 39.2% of the studied nurses stated that, they did not know the importance of FCDC, while reported the correct barriers confronting its application. On the other hand all of them reported correct answers immediately after the program implementation and at follow up respectively, with a very highly statistically significant differences detected at p=0.000

Concerning to nurses' knowledge about routine daily care interventions, **table (3)** of the current study illustrated that, 45%, and 51%, of the studied nurses stated the correct answers related to benefits of care clustering, and nesting/swaddling, while 82.4%, of them were not aware about the best baby position after care, pre the intervention program compared with all (100%) of them, who reported the correct answers immediately after and at follow up respectively, with a very highly statistically significant differences at p=0. 000.

As regards the nurses' knowledge about preterm infants' pain, the same table proved that 45.1% of the studied nurses, know the most painful procedures can preterm infant exposed to at NICU, while 64.7%, of them stated incorrect answers

related to nursing interventions that can relieve preterm infant' pain preprogram intervention, the knowledge which improved to be 100% correct answers immediately after and at follow up respectively, with a very highly statistically significant differences at p=0.000.

In relation to nurses' knowledge about kangaroo mother care, the same table indicated that, 3.9%, 37.2% of the studied nurses showed an improvement in their knowledge about definition and benefits of kangaroo mother care preprogram intervention, to all (100%) of them stated correct answers immediately after implementation of the program and at follow up respectively, with a very highly statistically significant differences at p=0.000.

Concerning nurses' knowledge about breast milk expression, apparently, **table (3)** clarified that, 78.4 %, 82.4%, and 41.1% of the studied nurses were knowledgeable about benefits, best container for storage, and storage duration pre the intervention program, the knowledge which improved to all (100%) of them respectively immediately post and at follow up respectively, with statistically significant differences at p≤ 0.001.

Table (4): proved that preprogram implementation, 70.6%, of the studied nurses reported that they did not know the standard noise level at the NICU, while 78.4%, 45.1%, and 82.4%, of them reported the correct NICU' noise sources, were aware about the harmful effect of noise on preterm infants, and reported the correct interventions to protect the preterm infants from the harmful effect of continues noise. The nurses' knowledge improved to be all of them (100%) reported correct answers immediately post program and at follow up respectively, with statistically significant differences at p=0.000, and 0.001.

As regards to nurses' knowledge about NICU lightening, this table showed that, 86.4 %, 55%, and 54.9% respectively of the nurses stated that they did not know the standard light level at the NICU, unaware about the harmful effect of light on preterm infants, while reported the correct interventions to protect the preterm infants from the harmful effect of continues light on the preterm infants pre the intervention program. The same table also showed that the nurses' knowledge improved to be all (100%) of them reported the correct answers immediately post program implementation and at follow up respectively, with statistically significant differences at p≤0.005.

Concerning nurses' knowledge about family centered care, it is evident from **table (5)** of the current study that, 39.3%, and 51% of the studied nurses correctly defined family centered care, and reported that, they did not know family centered care benefits, while 49% of them stated incorrect answers regarding to barriers facing family centered care application pre the intervention program, the knowledge which improved to be all (100%) of them immediately after the program and at follow up respectively, with very highly statistically significant differences at p=0.000.

As regards the effect of the educational program on nurses' total knowledge about FCDC**, table (6)** clarified that, there was a statistical significant difference in relation to sufficient nurses' knowledge about FCDC before conducting the program, immediately after and at follow up, 13.7%, 100%, and 100% respectively, with a high statistical significant difference at p ≤0.001.

Concerning nurses' practices regarding to FCDC interventions through routine daily care, **table (7)** revealed that 100% of the nurses were always practices only two elements" care clustering and encouraging breast feeding" during all of the program phases, with a very highly statistically significant differences detected at p=0.000.

Meanwhile, this table illustrated that, all and most of the studied nurses100%, 88.2%, 74.5%, 94.1%, 72.5% and 100% did not follow any practices to prevent harmful effect of continuous noise and light at NICU on preterm infants pre the intervention program, with exception for all (100%) of them were always covered preterm eyes during phototherapy sessions, compared with improvement of the nurses' practices through high percentages of them always practicing the same elements immediately post program and at follow up respectively.

Apparently, the same table showed that all (100%) of the studied nurses did not allow preterm infants' mothers to be integrated into their infants' care pre the intervention program, while this percent decreased to 52.9%, and 38.3% of them were always encouraged preterm infants' mothers to share their infants' care immediately post program and at follow up respectively, with a very highly statistically significant differences detected at p=0.000.

Regarding the effect the educational program on total nurses' practice of FCDC interventions according to researcher observation, **table (8)** indicated that, all (100%) of the studied nurses had an unsatisfactory practice pre implementation of the program, which decreased to 0% and 4.3% , respectively immediately post and at follow up. furthermore, the same table cleared that, there were statistically significant differences between before and immediately after program implementation as well as between before and at follow up phase of the program implementation at p=0. 000.

Table (9), as regards the relation between characteristics of the studied nurses and their total knowledge about FCDC before, post and at follow up of the program implementation, this table revealed that there were no statistically significant relations were found between the characteristics of the studied nurses and their knowledge except in level of education, as with a university graduation the total knowledge level was increased, at p>0.05.

Table (10), concerning the relation between characteristics of the studied nurses and their total practices of FCDC before, post and at follow up of the program implementation, this table illustrated that, there were no statistically significant relations between the characteristics of the studied nurses and their total practice throughout program phases.

Table (1); Characteristics of the studied nurses

Characteristics	N= 51 (100%)	
	No	%
Age (years)		
• < 20	2	3.9
• 20 < 25	28	54.9
• 25 < 30	14	27.5
• > 30	7	13.7
$\bar{\chi}$ ± **SD**	25.6±2.7	
Qualification		
• Bachelor degree in nursing	33	64.7
• Diploma of nursing	18	35.3
Experience (years)		
• <1	15	29.4
• 1-5	22	43.2
• 5 < 10	10	19.6
• >10	4	7.8
Attended any training courses about FCDC		
• Didn't attend	51	100

Table (2): Number and percentage distribution of nurses' knowledge about FCDC approach before implementation of the study program, immediately after, and at follow up.

Knowledge's items	Before (n=51)						Immediately After (n=51)						Follow-up (n=47)						X^2	p-value
	Correct		Incorrect		Don't Know		Correct		Incorrect		Don't Know		Correct		Incorrect		Don't Know			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%		
Definition	14	27.5	15	29.3	22	43.2	51	100	0	0	0	0	47	100	0	0	0	0	115.8	0.000*
Components	17	33.3	12	23.5	22	43.2	51	100	0	0	0	0	47	100	0	0	0	0	81.8	0.000*
Principles	7	13.7	19	37.5	25	49	51	100	0	0	0	0	47	100	0	0	0	0	19.9	0.000*
Benefits	16	31.5	11	21.5	24	47	51	100	0	0	0	0	47	100	0	0	0	0	75.2	0.000*
Barriers	20	39.2	13	25.5	18	35.3	51	100	0	0	0	0	47	100	0	0	0	0	87.9	0.000*

(*)Statistically significant difference at $P < 0.05$

Table (3): Number and percentage distribution of nurses' knowledge about routine daily nursing care interventions, before implementation of the study program, immediately after, and at follow up.

Knowledge's items	Before (n=51)						Immediately After (n=51)						Follow-up (n=47)						X^2	p-value
	Correct		Incorrect		Don't Know		Correct		Incorrect		Don't Know		Correct		Incorrect		Don't Know			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%		
Handling and positioning																				
Benefits of care clustering	23	45	17	33.3	11	21.7	51	100	0	0	0	0	47	100	0	0	0	0	66.2	0.000*
Benefits of nesting / swaddling	26	51	24	47	1	2	51	100	0	0	0	0	47	100	0	0	0	0	128	0.000*
Best baby position after care	7	13.7	42	82.4	2	3.9	51	100	0	0	0	0	47	100	0	0	0	0	46.9	0.000*
Pain																				
The most frequent painful procedure	23	45.1	16	31.4	12	23.5	51	100	0	0	0	0	47	100	0	0	0	0	78.3	0.000*
Nursing measures to manage pain	18	35.3	33	64.7	0	0	51	100	0	0	0	0	47	100	0	0	0	0	69.1	0.000*
Kangaroo mother care	2	3.9	32	62.8	17	33.3	51	100	0	0	0	0	47	100	0	0	0	0	57.7	0.000*
Definition of kangaroo mother care	19	37.2	32	62.8	0	0	51	100	0	0	0	0	47	100	0	0	0	0	119	0.000*
Benefits of kangaroo mother care	40	78.4	6	11.8	5	9.8	51	100	0	0	0	0	47	100	0	0	0	0	22.8	0.001*
Breast milk expression	42	82.4	5	9.8	4	7.8	51	100	0	0	0	0	47	100	0	0	0	0	18.4	0.001*
Benefits of breast milk expression	21	41.1	19	37.3	11	21.6	51	100	0	0	0	0	47	100	0	0	0	0	72.1	0.000*
container for milk storage																				
Duration of expressed milk storage																				

(*) Statistically significant difference at $P < 0.05$

Table (4): Number and percentage distribution of the studied nurses according to their knowledge about supportive NICUs environment before implementation of the study program, immediately after, and at follow up.

Knowledge's items	Before (n=51)						Immediately After (n=51)						Follow-up (n=47)						X^2	P-value
	Correct		Incorrect		Don't Know		Correct		Incorrect		Don't Know		Correct		Incorrect		Don't Know			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%		
• **Noise**																				
Standard noise level at NICUs	8	15.6	7	13.8	36	70.6	51	100	0	0	0	0	47	100	0	0	0	0	140	0.000*
Noise sources at NICUs	40	78.4	11	21.6	0	0	51	100	0	0	0	0	47	100	0	0	0	0	22.8	0.001*
Effect of noise on preterm infants	23	45.1	11	21.6	17	33.3	47	92.2	4	7.8	0	0	45	95.7	0	0	2	4.3	61.2	0.000*
Interventions to limit noise effect	42	82.4	9	17.6	0	0	51	100	0	0	0	0	47	100	0	0	0	0	18.4	0.005*
• **Light**																				
Standard light level at NICUs	1	1.9	6	11.7	44	86.4	51	100	0	0	0	0	47	100	0	0	0	0	144.6	0.000*
Effect of light on preterm infants	6	11.7	17	33.3	28	55	51	100	0	0	0	0	47	100	0	0	0	0	123	0.000*
Interventions to limit light effect	28	54.9	23	45.1	0	0	51	100	0	0	0	0	47	100	0	0	0	0	52.2	0.000*

(*)Statistically significant difference at $P < 0.05$

Table (5): Number and percentage distribution of nurses' knowledge regarding to family centered care before implementation of the study program, immediately after, and at follow up.

Knowledge's items	Before (n=51)						Immediately-After (n=51)						Follow-up (n=47)						X^2	p-value
	Correct		Incorrect		Don't Know		Correct		Incorrect		Don't Know		Correct		Incorrect		Don't Know			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%		
Definition of family centered care	20	39.3	12	23.5	19	37.2	51	100	0	0	0	0	47	100	0	0	0	0	75.2	0.000*
Benefits of family centered care	9	17.6	16	31.4	26	51	51	100	0	0	0	0	47	100	0	0	0	0	112.3	0.000*
Barriers facing application	6	11.7	25	49	20	39.3	51	100	0	0	0	0	47	100	0	0	0	0	123.8	0.000 *

(*)Statistically significant difference at $P < 0.05$

Table (6); Effect of the educational program on nurses' total knowledge about FCDC, pre implementation of the study program, immediately after, and at follow up.

Nurses' knowledge	Pre(n= 51)		Post (n=51)		Follow up (n=47)		Z & p1	Z & p2
	No	%	No	%	No	%		
• Insufficient	44	86.3	0	0	0	0	119.9	133.4
• Sufficient	7	13.7	51	100	47	100	0.000*	0.001*

(*) Statistically significant at P>0.05

Z1=differences between before & immediately after

Z2=differences between before & follow up

Table (7): Number and percentage distribution of the studied nurses according to their practice of FCDC interventions before implementation of the study program, immediately after, and at follow up.

Practice's items	Pre (n=51)						Post (n=51)						Follow(n= 47)						X^2	t- test
	Not done		sometimes done		Always done		Not done		sometimes done		Always done		Not done		sometimes done		Always done			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%		
• **Routine care**																				
Perform clustering of care	0	0	0	0	51	100	0	0	0	0	51	100	0	0	0	0	47	100	-	-
Support breast feeding	0	0	0	0	51	100	0	0	0	0	51	100	0	0	0	0	47	100	-	-
Maintain flexed Position(nesting)	33	64.7	16	31.4	2	3.9	33	64.7	14	27.5	37	72.5	1	2.1	16	34	31	66	90.5	0.000*
Provide gentle handling	14	27.5	26	51	11	21.6	14	27.5	5	9.8	46	90.2	0	0	16	34	31	66	61.6	0.000*
Encourage kangaroo care	51	100	0	0	0	0	51	100	19	37.3	32	62.7	3	6.4	14	30	30	63.8	137.3	0.000*
Apply pain management measures	26	51	25	49	0	0	26	51	25	49	26	51	0	0	15	31	24	51	84.1	0.000*
• **NICU environment**																				
Maintain quiet speech conversation	51	100	0	0	0	0	0	0	29	56.9	22	43.1	2	4.3	26	56.3	19	40.4	140.6	0.000*
Put nothings above the incubator	45	88.2	6	11.8	0	0	0	0	20	39.2	31	60.8	1	2.1	17	36.2	29	61.7	121.	0.000*
Responded quickly to baby crying	38	74.5	13	25.5	0	0	0	0	10	19.6	41	80.4	1	2.1	17	36.2	29	61.7	110.	0.000*
lower alarms to minimum heard level	48	94.1	3	5.9	2	3.9	0	0	11	21.6	44	86.3	0	0	6	12.8	38	80.9	139.	0.000*
Responded quickly to alarms	37	72.5	12	23.5	0	0	0	0	8	15.7	43	84.3	2	4.3	15	31.9	30	63.8	101.	0.000*
Put cover above incubator	51	100	0	0	0	0	0	0	14	27.5	28	54.9	11	23.4	14	29.8	22	46.8	85.90	0.000*
Turn off room light after care	51	100	0	0	51	100	0	0	28	54.9	20	39.2	3	6.4	25	53.2	19	40.4	125.1	0.000*
Cover preterm eye during phototherapy	0	0	0	0	0	0	0	0	0	0	51	100	0	0	0	0	47	100	-	-
• **Mother integration in her infant care**	51	100	0	0	0	0	7	13.7	17	33.3	27	52.9	16	34	13	27.7	18	38.3	86.7	0.000*

(*) Statistically significant difference at P < 0.05

Table (8): effect of the educational program on total nurses' practice of FCDC, pre implementation of the study program, immediately after, and at follow up.

Nurses' practice		Pre (n=51)		Post (n=51)		Follow up (n=47)		Z&p1	Z&p2
		No	%	No	%	No	%		
Unsatisfactory		51	100	0	0	2	4.3		
Satisfactory	**Good**	0	0	10	19.6	19	40.4	6.655	6.040
	Competent	0	0	41	80.4	26	55.3	0.000*	0.000*

(*) Statistically significant at P>0.05
Z& p1=differences between before & immediately after
Z& p2=differences between before & follow up.

Table (9): Relation between characteristics of the studied nurses and their total knowledge before implementation of the study program, immediately after, and at follow up.

Characteristics	Pre				post				Follow up				Z & p1	Z &p 2
	Sufficient knowledge		Insufficient knowledge		Sufficient knowledge		Insufficient knowledge		Sufficient knowledge		Insufficient knowledge			
	No	%	No	%	No	%	No	%	No	%	No	%		
Age														
• < 20	0	0	2	4.6	5	9.8	…	…..	6	12.7	……	……	0.564	1.763
• 20< 25	3	42.9	25	56.8	33	64.8	…	…	24	51.2	……	……	0.754	0.414
• 25< 30	3	42.9	11	25	8	15.6	…	…	10	21.2	……	……		
• > 30	1	14.2	6	13.7	5	9.8	…	…	7	14.9	……	……		
Level of education:														
• Diploma	1	14.2	17	38.9	10	19.6	……	……	16	34	……	……	21.05	6.502
• High education	6	85.8	27	61.1	41	80.4	……	…	31	66	…	…	0.000*	0.039*
Experience														
• < 1year	3	42.9	16	36.2	4	7.8	……	……	2	4.2	……	……	.614	5.249
• 1 to <5 years	1	14.2	17	38.9	37	72.5	……	……	28	59.5	……	……	0.893	0.154
• 5 to <10years	1	14.2	6	13.6	7	13.7	……	……	15	32	……	……		
• 10 years and more	2	28.5	5	11.3	3	5.8	……	……	2	4.2	……	……		

(*) Statistically significant at P>0.05
Z& p1=differences between before & immediately after
Z& p2=differences between before & follow up

Table (10): Relation between characteristics of the studied nurses and their practices before implementation of the study program, immediately after, and at follow up.

Characteristics	Pre				post				Follow up				Z & p1	Z & p2
	Unsatisfactory (n=51)		Satisfactory (n=0)		Unsatisfactory(n=0)		Satisfactory (n=51)		Unsatisfactory(n=2)		Satisfactory (n=45)			
	No	%	No	%	No	%	No	%	No	%	No	%		
Age														
• < 20	2	3.9	……	……	……	……	1	1.9	0	0	0	0	4.212	4.333
• 20-<25	28	54.9	……	……	……	……	24	47	0	0	24	53.3	0.648	0.667
• 25-<30	14	27.5					17	33.5	2	100	14	31.2		
• > -30	7	13.7					9	17.6	0	0	7	15.5		
Level of education:														
• Diploma	33	64.7	……	……	……	……	34	66.7	0	0	13	28.8	0.784	1.412
• High education	18	35.3					17	33.3	2	100	32	71.2	0.676	0.911
Experience														
• < -1year	15	29.5	……	……	……	……	13	25.1	1	50	9	20	9.480	11.20
• 1 -<5years	22	43.1	……	……	……	……	23	46	0	0	22	48.8	0.148	0.237
• 5 -<10 years	10	19.6					8	15.2	1	50	7	15.5		
• 10 years andmore	4	7.8					7	13.7	0	0	7	15.5		

(*) Statistically significant at P>0.05
Z& p1=differences between before & immediately after
Z& p2=differences between before & follow up

Discussion

Family centered developmental care, relates to a broad category of interventions includes control of external stimuli, parental involvement, breastfeeding, nursing interventions to promote stability (e.g., nesting, swaddling), and pain management [(10)]. These interventions designed to help the preterm infants during their adaptation to an extra- uterine life, minimize the stress of the NICU on the preterm infant's development and helps NICUs be more "baby friendly", to optimize neurodevelopmental outcomes for the NICU preterm infants and their families [(18)].

Establishing the direct nursing care for each diagnosis for the preterm infants at NICU is a main role of the neonatal nurse. Furthermore, the neonatal nurse is responsible for implementing a care that valorizes the physical, mental and social development of those fragile infants. So, can guide FCDC for the successful implementation [(19, 20)].

Concerning to the nurses' characteristics, the present study **(table 1)** revealed that, less than two thirds of the nurses had university graduations, and more than two fifth of nurses spend between one and five years experiences working at NICU. These findings was in an agreement with the results of the studies conducted by **Ahmed & Hani (2017) and by Fayed, Elbahnasawy, &Omar (2016)** [(21, 22)], as both studies showed that the, more than half of the neonatal nurses had Bachelor degree, and less than two thirds of the nurses were held in 1-3 years of working experience in the NICU.

Apparently, the result of the current study clarified that no nurses attended any previous training courses about FCDC. This finding goes in the same line with the study of **El - Sayed et al., (2013)** [(23)], who found that most of nurses did not attend any previous in-service training program related to neonatal care at NICU. The researcher relay that to the lack of in-services education and staff development at the hospitals. Moreover, from the researcher point of view, insufficient nurses' knowledge and unsatisfactory practices about FCDC could be attributing to less experience and to lower level of nurses' education.

As regards the studied nurses' knowledge about FCDC, the current study through (table 2) revealed that, more than two fifths of the studied nurses reported that they do not know the definition, components, or the importance FCDC. As well as, less than half, and more than one third of them reported that they don't know the principles of FCDC pre the intervention program compared to all of them stated the correct answer post program implementation and at follow up. These findings are parallel to the findings of Mohammed, Bayoumi, and Mahmoud (2014) [(24)], who conducted a study about" The Effect of Developmentally Supportive Care Training Program on Nurses' Performance and Behavioral Responses of Newborn Infants", at Benha University, Egypt, and found that the majority of NICU nurses have poor knowledge regarding developmental supportive care.

While the previous findings of nurses' knowledge confronting with the findings of the study conducted by Rahmah, Febriana, and Abdullah (2016) [(25)], about "knowledge and attitudes of neonatology nurses towards developmental care at Yogyakarta, Indonesia", where they found that, 90.62 % of nurses answered correctly on the definition of developmental care, and stated that neonatal nurses have moderate knowledge of developmental care. The researcher attributed this contradiction to a cultural

difference and to different health care attitude and practices.

As regards nurses' knowledge about routine daily care interventions related to FCDC, the present study **(table 3)** revealed that more than two fifths of the studied nurses reported the complete correct answer for benefits of care clustering preprogram implementation compared with all of them stated the correct answer immediately after implementation of the program and at follow- up. In agreement with **Valizadeh, Avazeh, Hosseini, and Jafarabad (2014)** [(26)], who conducted a study about "Comparison of Clustered Care with Three and Four Procedures on Physiological Responses of Preterm Infants: Randomized Crossover Clinical Trial" and recommend that care clustering should be considered as an essential caring method in NICUs, and neonatal nurses should be equipped with information in this field.

Additionally, the current study **(table 3)** emphasized that, more than two thirds of the studied nurse's stated incorrect answer related to the best baby position after care, and more than half of them stated the correct benefits from nesting and swaddling pre the intervention program compared with all of them stated the complete correct answer post program implementation and at follow up. Similarly, **Chen et al., (2014)** [(27)], who conducted a study about "Improving the provision of nesting and positioning for premature infants by nurses in neonatal intensive care units" and found that nurses' knowledge in term of preterm infant nesting and positioning increased from 58.3% to 92.3% after implementation of a program designed to improve nursing staff cognition and skills regarding nesting and positioning for premature infants in the NICU.

On investigating the studied nurses' knowledge about pain **(table 3)** of this study addressed that, more than two fifths of the studied nurses reported the correct answer related to the most painful procedures for preterm infant at NICU, while less than two thirds of studied nurses reported incorrect answer related to pain management pre the program implementation. this finding was congruent with **Cruz, Fernandes , and Oliveira (2016)** [(27)], in their study about " Epidemiology of painful procedures performed in neonates: a systematic review of observational studies", who concluded that pharmacological and non-pharmacological approaches were inconsistently applied for preterm infants at NICU.

In relation to nurses' knowledge regarding kangaroo mother care (table 3) of the current study, reflected lack of nurses' knowledge preprogram implementation. This finding is consistent with the finding of the study conducted by **Chan, Labar, Wall, and Atun (2016)** [(28)], to investigate factors influencing the adoption of kangaroo mother care in different contexts, as the researchers found that nurses had inadequate knowledge regarding KMC.

The same study result proofed improvements in the nurses' knowledge regarding kangaroo care after implementation of the program **(table 3).** This result was in harmony with several Egyptian researches as the researches done by **El-Nagger, Abed El-Azim and Hassan (2013)** [(29)], about " Impact of neonatal nurses' guidelines on improving their knowledge, attitude and practice toward kangaroo mother's care", by **Abd El Moniem and Morsy (2011)** [(30)], about "The effectiveness of kangaroo technique on preterm infant's weight gain", and by **El-Nagar, Lawend, and Mohammed (2013)** [(31)], about " Impact of neonatal nurses' guidelines on improving their knowledge, attitude and practice toward kangaroo mother's care" whose concluded that educational programs and guidelines

were effectively improved neonatal nurses' knowledge, attitude and practice about KMC.

Concerning evaluation of nurses' knowledge regarding to breast milk expression, the present study **(table 3)**, revealed that, more than three quarter of the studied nurses , majority of them , and two fifths respectively, were identify the complete benefits of the breast expression , report best material for expressed milk storage container, and expressed milk storage duration pre the educational program. The knowledge which improved to be all of them reported the correct answers post program and at follow up. In agreement with a recent Arabian study conducted at Northern Jordan by **Gharaibeh, Al-sheyab, and Malkawi (2016)** [32], about " Breast Milk Collection and Storage in the Neonatal Intensive Care Unit: Nurses' Knowledge, Practice, and Perceived Barriers", who found the neonatal nurses' knowledge of breast milk expression, were generally adequate.

The physical environment is an important component of developmental care **(Hutchinson, 2017)** [33]. However, noise level in Egyptian NICU exceeded the international permissible levels, and noisy events altered the preterm infants' physiologic stability. Accordingly, staff education is recommended to eliminate noise pollution with its deleterious effects on preterm infants **(Hassanein et al., 2013)** [34]. Therefore, the present study goes to investigate the nurses' knowledge regarding environmental noise and light at NICU.

The findings of the present study (table 4), emphasized that despite more than two thirds of the studied nurses were less knowledgeable about recommended noise level at the NICU pre the intervention program, more than three quarter and majority of them were aware about the noise sources and the strategies to reduce the noise in the unit, while these knowledge improved to be all of them were aware post program and at follow-up.

These findings are in agreement with the findings of the study conducted by **Daniele, Pinheiro, Kakehashi, and Balieiro (2012)** [35], about "workers' knowledge and perception regarding noise in neonatal unit", and noted that the majority of them don't know the standard levels of sound and concluded the importance of educational programs which raise consciousness concerning better environmental conditions. In contrary, the present study disagrees with an Indian study conducted by **Kumar, Margaret, Jyothi, and Lewis (2014)** [36], about "effectiveness of sensitization program on knowledge of staff regarding noise in neonatal intensive care unit of Kasturba hospital, Manipal", and found that, majority (71.4%) of staff, had an average knowledge regarding noise in NICU during the pre-test. The researcher owing this to that Manipal University is one of the top recognized universities in India, and might tracking with the medical standards at their NICUs.

According to Abou elfettoh and Ludington-Hoe (2013) [37], reduction of exposure to light in NICU is an important component of FCDC. The current study (table 4) revealed that majority of the studied nurses, and more than half of them were unaware about standard light level at NICU and have limited knowledge regarding the harmful effect of continuous light on the preterm infants. Despite this, more than half of the studied nurses reported the correct strategies to decrease these effects on the preterm infants pre program implementation. The current study result is in agreement with **Engwall , Fridh , Bergbom, Lindahl (2014)** [38], who found that the interventions to reduce effect of lighting in the intensive care unit is applied.

The quality and frequency of family participation in their preterm infant's care

in the NICU can play a significant role in their effectiveness after discharge. Their presence and involvement in the NICU offer a unique way to humanize the healthcare experience for infants, their families and their caregivers **(Bastani, Abadi, and Haghani, 2015)** [39]. In order to studying nurses' knowledge regards to family centered care (FCC), **(table 5)** of the current study clarified that near to two fifths of the studied nurses were aware about FCC definition pre the intervention program, while more than half and two fifths of them didn't know the benefits or barrier to its implementation pre the intervention program.

These findings were on track with both novel studies conducted at Saudi Arabia by **Alabdulaziz, Moss, and Copnell (2017)** [40]**,** about " Pediatric nurses' perceptions and practices of family-centered care in Saudi hospitals" and by **Elarousy and Alnajjar (2017)** [41], about " Exploring Nurses', Doctors' and Parents' Perception on Family Needs in Pediatric Critical Care Units at King Khaled Hospital-Jeddah", where indicated that nurses had limited knowledge about FCC as a care model, and recommended that neonatal nurses should be aware about the family needs to improve the implementation of family centered care approach.

The current study proofed a highly significant difference in total nurses' knowledge about FCDC after implementation of the educational program at $p \leq 0.001$ **(table 6).** this finding is in concert with **Mosqueda-Peña et al.,(2016)** [42], who conduct a study about " Impact of a developmental care training course on the knowledge and satisfaction of health care professionals in neonatal units: A multicenter study", and in the same line with both Arabian studies done by **Ahmed et al., (2013)** [43], who conducted a study about" Effect of Instructional Sessions on Nurses' and Doctors' Knowledge and Practice regarding Developmental Care in NICU in Abha City", and by **El Sayed et al., (2013)** [23], who conducted a study about " Establishing Basic Standards of Nursing care protocol at Neonatal Intensive care unit" those researchers found that course attendance and instructional session about family centered developmental care had an effective role in enhancing nurses' knowledge about FCDC at posttest, and emphasized that education and training increase nurses' knowledge.

Concerning nurses' practices regarding daily routine nursing interventions, the present study revealed that all of nurses were always implement routine care clustering during all phases of the program **(table 7).** The researcher believed that the reason behind such high rate of practice because of time limited before physician round and not for nurses' awareness about importance of care clustering. In this regard **Valizadeh et al., (2014)** [26], in his study about " Comparison of Clustered Care with Three and Four Procedures on Physiological Responses of Preterm Infants: Randomized Crossover Clinical Trial", illuminated that clustering of routine care is recommended for reduction of stress, and to provide rest opportunity for preterm infant.

Additionally, the current study clarified that all nurses were always encouraging breast-feeding during all phases of the intervention program **(table 7**). The researcher believed that nurses' complete adherence to breast-feeding is due to global governmental recommendations from Egyptian ministry of health toward breast-feeding and subsequently physicians' attitude, as the feeding method is not nurses' decision even if the nurse has a positive attitude toward breast-feeding she will do what the physicians recommended. This finding disagrees with **Wight (2015)** [44], who

conducted a study about" Breastfeeding the NICU Infant: What to Expect" and mentioned that many infants leave the NICU not receiving sufficient or any breast milk.

The present study at the same table (table 7), clarified that two thirds of the study nurses did not care about maintain flexed position of preterm infants through nesting/ swaddling preprogram versus to higher percentages immediately post and at follow respectively. In Accordance with a Chinese study conducted by **Chen et al., (2014)** [27], about "improving the provision of nesting and positioning for premature infants by nurses in neonatal intensive care units" and found that nurses' practices regarding nesting and positioning improved from 58.3% pre project to 92.3% after the project implementation.

As regards to nurses' practices of encouraging kangaroo care, the present study reflected improvement of nurses' practices after the intervention program implementation **(table 7).** This result similar to the result of the Egyptian study conducted by **El-Nagar et al., (2013)** [29], about " impact of neonatal nurses' guidelines on improving their knowledge and practices toward kangaroo mother's care" and found that, 60% of nurses did not assist mothers in kangarooing her infant in pretest compared to 73% of them encouraging kangarooing posttest.

The present study also indicated that, more than half of the nurses never apply measures to reduce preterm infants' pain pre the program table (7). This result consistently with the findings of studies from various countries; as the study survey conducted in the United States and China by **Cong et al., (2014)** [45], about " Neonatal nurses' perceptions of pain management" and reflected that pain has not been well managed in many NICUs.

On contrary, the finding of the current study regarding practices of FCDC approaches through daily routine care interventions (table 7), is versus to the findings of an Iranian study conducted by **Godarzi, Rahimi, Khalessi, Soleimani, and Mohammadi (2015)** [46], about " The rate of developmental care delivery in neonatal intensive care unit " who found highest rate of developmental care delivery related to the daily routine care domains. The researcher relay this difference to cultural differences and different health care practices.

Regarding nurses' practices for maintaining supportive environment, the present study indicated relatively high percentages of nurses did not practices any noise reduction measures preprogram compared with decreased percentages respectively post program (table 7). In agreement with **Carvalhais, Santos, Vieira da Silva and Xavier (2015)** [47], in his study about "Is there sufficient training of health care staff on noise reduction in neonatal intensive care units? A pilot study from Neonoise Project", and found a significant difference between nurses' practices before and after training and recognized that a training program is quite important to change behaviors and effectively control noise in the NICU.

As regards to nurses' practices to protect preterm infants from the effect of direct and continuous light exposure, the current study (table 7), showed that all of nurses didn't practices any measures to protect preterm infants from continuous light exposure preprogram, compared to more than half of them were performed some measures to protect preterm infant from light immediately post program. The finding are in line with finding of **Godarzi et al., (2015)** [46], who noticed that the neonatal nurses were unable to decrease the intensity of NICU light to the standard level.

In regards to FCC related nurses' practice, the present study (table 7). illuminated that no nurse integrated preterm infants' mothers into their infants'

care pre the intervention program while this percent decreased immediately post program and at follow up respectively Similar to the finding of **Stokowski (2015)** [48], in his study about " The Missed List: Revelations of Busy NICU Nurses" who found that more than one third of nurse missed to include parents in care.

On contrary, the finding of the present study versus the finding of the Iranian study conducted by **Godarzi, et al., (2015)** [27], who found increased rate of FCC delivery at NICU, where the nurses provided parents with the opportunity of implementing daily care measures. Moreover, allowed parents to sing lullaby, cuddle their infants, and sometime attend neonates' invasive procedures. The researcher relay that to that the nurses at the Iranian study already had previous knowledge related to developmental care before program implementation, which consequently means that they already practice developmental care.

Totally, According to researcher observation, the present study illustrated statistically significant differences between nurses' practices before, immediately after the program as well as at follow up phase of the program implementation (table 8). This finding was confirmed by the Egyptian study conducted at Benha, by **Mohammed et al., (2014) [24],** who explored highly significance differences between the means of the total scores of nurses' performance before and after application of developmentally supportive care program.

Concerning the relation between characteristics of the studied the nurses' and their total knowledge and practices about FCDC, the current study recognized that nurses' level of education only influenced their knowledge **(table 9)** while negative relations were found between nurses' characteristics and their practices through program phases **(table 10)**. In agreement with Egyptian study done by **Badr, Morsy, and Ali, (2015)** [49], who found that the baccalaureate degree participants have higher means in knowledge compared to diploma degree, with no statistical difference among the means of knowledge and practice scores of participants' age or years of experience.

Conclusion & recommendations:

It was concluded that, the educational program has positive effects on improving nurses' knowledge and practice. The study recommends including the family centered developmental care interventions into nursing care protocols as a routine, create developmental care team with physicians, and nurses to follow the application of family centered developmental care, As well as assessing mothers' barriers that hindering them from being a part of their preterm infant life at NICU, and using media for providing the knowledge and support for mothers of preterm infants in sharing their preterm infants' care. In addition, continuous training is essential to change the attitude of medical team toward including family in care plan for the preterm infants.

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