

## Effect of Preterm Neonates' Developmental Supportive Care Program on Nurses' Performance

<sup>1</sup>Randa El-Sayed Mohammed, <sup>2</sup>Gehan Maher Khamis, <sup>3</sup>Yomn Youssef Sabry

<sup>1</sup> Preceptor of Pediatric Nursing,

<sup>2</sup>Lecturer of Pediatric Nursing, <sup>3</sup> Professor of Pediatric Nursing

<sup>1, 2, 3</sup> Faculty of Nursing, Alexandria University.

**Abstract:** Developmental care involves adjusting the neonatal intensive care unit to reduce stress and improve optimal brain and behavioral development of the preterm neonate. The aim of developmental care is to support each neonate to be as stable, well organized and competent as possible by responding to the neonate's cues and management them carefully. **Objective:** evaluate the effect of preterm neonates' developmental supportive care program on nurses' performance. **Setting:** This study was conducted at the Neonatal Intensive Care Unit (NICU) of Maternity University Hospital at El-Shatby in Alexandria. **Subjects:** All nurses who were responsible for providing care for preterm neonates (50 nurses). **Tool:** one tool was used to collect necessary data namely; Nurses' Performance of the Developmental Supportive Care for Preterm Neonates Observational Checklist. **Results:** The results of the current study revealed that, none of nurses obtained good score related to developmental supportive care before program. On the other hand, three quarters (74%) of nurses had good total score for developmental supportive care immediately after the application of the program. Unfortunately, this percent decreased to 42% three months later. There was statistical significant difference between nurses' performance total scores regarding developmental supportive care before, immediately after the application of the program, and three months later ( $p = <0.001$ ). **Conclusion:** It can be concluded that, nurses had good total score of performance regarding developmental supportive care immediately after the application of the program, and it declined three months after program application. **Recommendations:** Proper in-service training for nurses about the developmental supportive care interventions is mandatory to update their knowledge and improve their performance about developmental supportive care.

**Keywords:** Development Supportive Care Preterm Neonates

Nurses' Performance

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### I. Introduction

The progresses of science and technology in neonatal intensive care units (NICUs) have contributed to the increased survival of preterm neonates. However, factors such as the increase in the amount of equipment and number of invasive procedures, the constant need for light, the presence of ambient noise and the required excessive manipulation during care have resulted in a number of adverse effects. Subsequently, these effects trigger changes in the development of neonates, especially in preterm neonates<sup>(1-3)</sup>.

Preterm neonates are a particularly vulnerable population who require advanced medical interventions and highly specialized nursing care in order to survive. Worldwide, preterm birth affects almost 11.1% of all pregnancies. Actually, preterm births represent for approximately 70% of neonatal deaths and 36% of infant deaths<sup>(4,5)</sup>. The World Health Organization (2015)<sup>(6)</sup> has estimated that 15 million neonates are born preterm every year. In El-Shatby Maternity University Hospital in Alexandria (2011)<sup>(7)</sup>, the rate of preterm neonate in Neonatal Intensive Care Unit was 76.8% of the total number of admissions.

Despite the innovative interventions in medical field, preterm neonates remain at risk for a wide spectrum of long-term morbidity including cerebral palsy, mental retardation, developmental delay, school problems, behavioral issues, and overall poor health status. Several researches suggest that the cognitive disabilities, poor academic achievements, and disordered behavioral regulation seen in preterm, are the result of early disruption of their intrauterine life and sudden exposure to entirely unfamiliar NICU environment<sup>(8-13)</sup>.

Many neonates are admitted to NICUs every day for different reasons, with premature birth being the main reason. The human brain is developed largely in the last trimester of fetal life and away from direct environmental effects. Nutrition, body temperature control, and many internal regulatory systems help set up a fetal biological rhythm inside the uterus. In preterm neonates, this support system is replaced with completely different environmental stimuli in the NICU. They are exposed to an excess of stimuli from noise, light, activity, painful procedures, and separation from the mother which may have long term effects on the infant. The NICU acts as a harsh sensory stimulant that is unsuitable for the demands of the developing nervous system and thus

exposes the preterm infant to a wide range of morbidities. Therefore, there is a need to change neonatal care practices in NICU to support the neuro-developmental processes in extra uterine environment<sup>(14-16)</sup>.

The preterm neonates' brain should be protected by creating an environment suitable for neurobehavioral development. The developmental care is a broad category based on modification of the nursery environment and care practices which support the ongoing development of the preterm neonates. It includes a group of interventions designed to minimize stress of the NICU environment and to support the behavioural organization of each individual infant. In addition, it enhances physiological stability, protects sleep rhythms, and promotes growth and maturation<sup>(17)</sup>.

A variety of approaches are used in developmental care: for example, control of external stimuli (auditory, visual, tactile) by noise and light reduction as well as minimal handling, integration of parents, specific supportive behavioural techniques such as non-nutritive sucking, opportunities for grasping, swaddling, general motor containment, kangaroo care, neonate positioning, and pain management<sup>(17,18)</sup>. Although a growing body of evidence for developmental care practices, implementation has varied among institutions and widespread adoption has not been achieved yet. There have been few previously reported studies evaluating individualized developmental supportive care in NICU context. Learning the principles of developmental supportive care and understanding the meaning of preterm behavioral cues make it possible for NICU caregivers. So, developmental supportive care program could improve nurses' performance as well as decrease the preterm neonates' stress in NICU<sup>(19,20)</sup>.

#### **Aim of the Study:**

Evaluate the effect of preterm neonates' developmental supportive care program on nurses' performance

#### **Hypothesis:**

1. Nurses who receive preterm neonates' developmental supportive care program demonstrate good performance level of care provided for preterm neonates after program than before.

## **II. Materials and Method**

#### **Study design:**

A quasi-experimental design was used.

#### **Setting:**

The current study was carried out at the Neonatal Intensive Care Unit (NICU) of Maternity University Hospital at El-Shatby in Alexandria.

#### **Subjects:**

All nurses who were responsible for providing care for preterm neonates were included in the study (50 nurses).

#### **Tool:**

One tool was used to collect the necessary data:-

#### **Tool : Nurses' Performance of the Developmental Supportive Care for Preterm Neonates Observational Checklist:-**

It was developed by the researcher guided by the developmental clinical care guidelines<sup>(21-23)</sup> to assess nurses' performance of developmental care for preterm neonates.

It included the following items:-

- A. Postures support/positioning.(15 items)
- B. Reducing noise(8 items)
- C. Reducing light and vision (6 items)
- D. Containment (2 items)
- E. Kangaroo care (9 items)
- F. Non-nutritive sucking. (4 items)

- Scoring system for nurses' performances was done as follow:

Each item performed completely and correctly was given one mark and each item not performed or performed incorrectly was given zero.

- The total scores of nurses' practices were 44 marks distributed as follows:

- The total score of nurses' performance were categorized as follows:

- Good = 70% or more
- Satisfactory = 60% to less than 70%
- Unsatisfactory = less than 60%

Characteristics of the nurses were attached to this tool such as: nurses' age, level of education, and years of experience and previous attendance of developmental supportive care program for preterm neonates.

### **III. Method**

- An official letter was sent from the Faculty of Nursing, Alexandria University to Maternity University Hospital at El-Shatby in Alexandria in order to obtain the approval to collect the data and facilitate research implementation.
- A written approval was obtained from hospital administrative personnel after explaining the aim of the study to collect the necessary data.
- The tool was developed by the researcher guided by the developmental care guidelines.
- Tool was tested for its content validity by five experts in pediatric nursing field and its validity was 0.997.
- Reliability of tool was done by using Cornbach's alpha coefficient and reliability was 0.995.
- A pilot study was carried out on 5 nurses to test feasibility, applicability and clarity of the tool. No modifications were done. Those nurses were excluded from the study subjects.
- Nurses' performance of the developmental supportive care for preterm neonates was assessed before the program implementation by using tool I.
- The developmental supportive care program content was developed by the researcher based on the developmental clinical care guidelines<sup>(21, 22)</sup>. Educational program construction involve the following :

#### **I-Setting the Objectives:**

- The researcher developed the general and specific objectives of the program.

#### **The general objective of the program as follow:**

- Apply developmental supportive care for preterm neonates.

#### **The specific objectives of the program included the following:**

- Provide developmentally supportive positioning by the provision of boundaries, through the use of nesting and /or swaddling.
- Use different methods to reduce noise and maintain quite environment.
- Use different methods to reduce light.
- Demonstrate soothing intervention (non-nutritive sucking, containment of preterm neonate).

#### **II-Educational Content of the Program:**

According to the previously mentioned objectives content of the educational program were included :definition of preterm neonates, purpose of developmental supportive care, , and nurses' interventions to reduce noise, light and vision, postural support /positioning .In addition, soothing interventions such as non-nutritive sucking, containment, and kangaroo care.

#### **III-Determination and Selection of the Teaching Methods and Audiovisual Materials:**

The following teaching methods/aids were utilized: lectures, group discussion, and simulation, demonstration, poster, video film and power point presentation, as well as booklet were used as teaching media and instructional resources.

#### **IV-Preparation of the Environment to Apply the Developmental Supportive Care of Preterm Neonates:**

- ✓ The researcher prepared the needed equipment that help nurses to apply the program such as 220 nests and neonates' eye cover and head cover.
- ✓ The researcher took approval to put windows glass sticker to decrease effect of sun rays on the preterm neonates and provide dim light to neonates
- ✓ The noise level was assessed in the intensive care unit and the sound of monitor alarm was 80 decibel before the program.
- ✓ The sound of the cardiac monitor and pulse oximeter were reduced to the lowest level.
- ✓ The level of sound was kept inside the incubator at the lowest level.
- ✓ The researcher used I phone application for measuring the noise level.

#### **V-Implementation of the Program:**

- The total number of nurses were divided into 7 groups, each group includes 3 to 10 nurses according to their work schedule.
- Each group attended two sessions and the time of each session around 45 minutes

- Sessions were carried out in the hospital over a period of 2 weeks starting from 18 June to 8 July 2017.
- Demonstration of session was done at morning and afternoon shifts.
- The first educational session cover all theoretical content highlighted an overview about the definition of developmental supportive care, benefits of applying developmental elements of developmental care
- The second session involved demonstration of how to apply nursing interventions to reduce noise and light, postural support /positioning, containment, non nutritive sucking and kangaroo care.
- The researcher demonstrated all clinical aspects of developmental supportive care to every nurse individually.
- The researcher observed every nurse individually during re-demonstration of all intervention regarding developmental supportive care.
- The researcher summarized each session and feedback of the audience was emphasized.

**VI-Evaluation of the program**

- The program was evaluated by re-observing nurses' performance immediately after the program and three months later.
- The observer did not interfere with the nurses' performance while providing care for preterm neonates.
- The researcher used observational checklist tool to assess nurses' performance of the developmental supportive care for preterm neonates.

**Ethical considerations include:**

- Witness informed consent was obtained from the head nurse of the neonatal intensive care unit and a written consent from all parents of preterm neonates after providing appropriate explanation about purpose of the study and they have the right to withdraw at any time.
- Data privacy and anonymity of study subject, confidentiality of the collected data was guaranteed.

**Statistical Analysis**

- Collected raw data were revised, coded and transferred into specially designed formats to be suitable for computer feeding and entered into SPSS files system (SPSS package version 13). Following data entry, checking and verification processes were carried out to avoid any errors during data entry.
- The following statistical measures were used:
  - Descriptive statistics includes percentage, mean, and standard deviation were used to describe different characteristics.
  - Cronbach's Alpha test, Monte Carlo for Chi square test, ANOVA test was used for test of significance.
  - The significance of results was at the  $p \leq 0.05$  or 0.0001 level of statistical

**IV. Result**

Table (1) illustrates socio- demographic characteristics of nurses. Regarding nurses' age, it was found that less than half of the nurses (46%) were between 30 to less than 40 years old, while 4% of them were 50 years or more. Regarding nurses' level of education, the results revealed that more than two thirds of the nurses (72%) had Technical Nursing School certificate, while 14% of them had Nursing bachelor degree. It was clear from the table that 40 % of the nurses had 15 to less than 20 years of experience, while 20% of them had 10 to less than 15 years of experience. It was observed that all nurses (100%) did not attend any program or courses regarding developmental supportive care of preterm neonates.

**Table (1): Socio- Demographic Characteristics of Nurses**

Characteristics of Nurses	N=50	
	No.	%
<b>Nurses' age (years)</b>		
20 –	11	22.0
30 –	23	46.0
40 –	14	28.0
50 and more	2	4.0
Mean ± SD	37.52 ± 8.01	
<b>Level of education-</b>		
Secondary nursing school	6	12.0
Technical nursing school	36	72.0
Nursing bachelor degree	7	14.0
Post- graduate diploma	1	2.0
<b>Years of experiences</b>		
<5	4	8.0
5-	9	18.0

10-	10	20.0
15-	20	40.0
20-	5	10.0
25-30	2	4.0
<b>Attendance of previous program about developmental supportive care for preterm neonates</b>		
Yes	0	0.0
No	50	100.0

Table (2) presents nurses' performance of postures support and positioning through phases of developmental supportive care program. In respect of supported side lying position, the table revealed that only 26 % of nurses supported the back and head of preterm neonates in midline by using nests and rolled towel before the program application. This percentage increased to 92% immediately after the program application. While three months after the program, this percent decreased to 88%. A statistical significant difference was found between the nurses performance before program application, immediately, and three months after the program application ( $p < 0.001$ ).

Eighteen percent of the nurses supported arms and hands of preterm neonates in midline by using nest and rolled towel before the program. This percent increased to 84% of nurses immediately, while this percent slightly decreased to 82% three months after the program application, and the difference was statistically significant between the nurses' performance before, immediately, and three months after the program application ( $p < 0.001$ ).

Supporting soles of feet of preterm neonates by the nest was performed by only 6% of nurses before the program application. Such percent increased among 84% and 76% of them immediately after the program and three months respectively with statistical significant difference ( $p < 0.001$ ).

According to supporting supine position, the same table revealed that six percent of nurses supported head of preterm neonates in neutral position by using rolled towel before the program. Such percent increased among 70% and 64% of them immediately after the application of program and three months later respectively with statistical significant difference ( $p < 0.001$ ).

Before the program application, more than half of the nurses (54%) kept the spine of preterm neonates straight. Meanwhile, immediately after the application of program, this percentage increased to 100%. Slight decrease (90%) was observed among those nurses after three months. Statistical significant difference was found between the nurses' performance before program application, immediately, and three months after the program application ( $p < 0.001$ ).

Keeping knees of preterm neonates closer to each other was done by more than one third of nurses (34%). This percent increased to 84% and 78% immediately after the application of program and three months later respectively with statistical significant difference ( $p < 0.001$ ).

It was observed from the same table that 44% of the nurses laid the preterm neonates on their chest with the hands flexed towards the face, knees tucked under the abdomen. While immediately and three months later after the program application, this percent jumped to around 92% and 90% respectively with statistical significant difference ( $p < 0.001$ ).

Placing a roll or soft blanket under the pelvis of preterm neonates was performed by only 26 % of nurses before the program. Such percent increased among 80% of them immediately after the program application. A decline was observed among those nurses to 70% three months later with statistical significant difference ( $p < 0.001$ ).

Moreover, the table showed that 30 % of nurses kept the spine straight, not curved to the right or left, and the back rounded. This percentage increased to 76% and 72% immediately after the program application and three months later respectively with statistical significant difference ( $p < 0.001$ ).

**Table (2): Nurses' Performance of Postures Support and Positioning through Phases of Developmental Supportive Care Program**

Content of Developmental Supportive Care Program	Before program				Immediately after program				3 months after program				p
	Not performed n=50		Performed n=50		Not performed n=50		Performed n=50		Not performed n=50		Performed n=50		
	No	%	No	%	No	%	No	%	No	%	No	%	
<b>1. Postures Support and Positioning</b>													
<b>a) Supported Side-Lying position</b>													
1. Support the back and head of preterm neonate in midline by using nest and rolled towel.	37	74.0	13	26.0	4	8.0	46	92.0	6	12.0	44	88.0	<0.001*
2. Support arms and hands of preterm neonate in midline (using nest rolled towel)	41	82.0	9	18.0	8	16.0	42	84.0	9	18.0	41	82.0	<0.001*
3. Bend legs of preterm neonate at the hips.	39	78.0	11	22.0	10	20.0	40	80.0	12	24.0	38	76.0	<0.001*
4. Place padding between knees and ankles of preterm neonate.	44	88.0	6	12.0	14	28.0	36	72.0	17	34.0	33	63.0	<0.001*
5. Support soles of feet of preterm neonate by the nest.	47	94.0	3	6.0	8	16.0	42	84.0	12	24.0	38	76.0	<0.001*
<b>b) Supported Supine Position</b>													
1. Support head of preterm neonate in neutral position and in the mid line (chin in line with sternum) by using rolled towel.	47	94.0	3	6.0	15	30	35	70.0	18	36.0	32	64.0	<0.001*
2. Keep spine of preterm neonate straight	23	46.0	27	54.0	0	0.0	50	100	5	10.0	45	90.0	<0.001*
3. Keep arms of preterm neonate forward	37	74.0	13	26.0	4	8.0	46	92.0	10	14.0	40	80.0	<0.001*
4. Keep knees of preterm neonate closer to each other.	33	66.0	17	34.0	8	16.0	42	84.0	11	22.0	39	78.0	<0.001*
<b>c) Supported Prone Position</b>													
1. Lay the preterm neonates on his chest with the hands flexed towards the face, knees tucked under the abdomen.	28	56.0	22	44.0	4	8.0	46	92.0	5	10.0	45	90.0	<0.001*
2. Place a roll or soft blanket under the pelvis of preterm neonate.	37	74.0	13	26.0	10	20.0	40	80.0	15	30.0	35	70.0	<0.001*
3. Keep the spine straight, not curved to the right or left, and the back rounded.	35	70.0	15	30.0	12	24.0	38	76.0	14	28.0	36	72.0	<0.001*

p: p value for **Friedman test** for comparing between before and Immediately after, 3 months after the program

\*: Statistically significant at  $p \leq 0.05$

Table (3) shows nurses' performance for reducing noise through phases of developmental supportive care program. It was clear from the table that three quarters (76%) of nurses closed incubator doors softly before the program application. Immediately after the application of the program and three months later, this percent increased among the majority of nurses (100% and 94% respectively) with statistical significant difference ( $p = <0.002$ ).

Before starting the program, it was clear that only 32% of nurses did not place any object on top of incubator. This percent increased among 72% of them immediately after the program application, but it declined to 64% three months later with statistical significant differences ( $p = <0.001$ ).

More than half of the nurses (62%) silenced alarms as soon as practicable before the program. Proper performance regarding the previous step was carried out by 94% and 82% of them immediately after the application of the program and three months later respectively with statistical significant difference ( $p = <0.001$ ). Concerning setting alarms and phones at the lowest safe level, it was found that 22% of nurses performed it before the program application. This percent increased to almost the same immediately after the application of the program and three months later (52% and 50% respectively) with statistical significant difference ( $p = <0.001$ ).

**Table (3): Nurses' Performance for Reducing Noise through Phases of Developmental Supportive Care Program**

Content of Developmental Supportive Care Program	Before program				Immediately after program				3 months after program				P
	Not performed n=50		Performed n=50		Not performed n=50		Performed n=50		Not performed n=50		Performed n=50		
	No	%	No	%	No	%	No	%	No	%	No	%	
<b>2.Reducing Noise</b>													
1. Close incubator doors softly.	12	24.0	38	76.0	0	0.0	50	100	6	12.0	47	94	0.002*
2. Do not place any object on top of incubator.	34	68.0	16	32.0	14	28.0	36	72.0	18	36.0	32	64.0	<0.001*
3. Silence alarms as soon as practicable.	19	38.0	31	62.0	3	6.0	47	94.0	9	18.0	41	82.0	<0.001*
4. Set alarms and phones at the lowest safe level.	37	74.0	11	22.0	22	44.0	26	52.0	23	46.0	25	50.0	0.001*
5. Do not use the radios in the unit.	14	28.0	36	72.0	2	4.0	48	96.0	4	8.0	46	92.0	<0.001*
6. Put ear muffs for preterm neonates during excessive noisy procedures.	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	-

p: p value for **Friedman test** for comparing between before and Immediately after, 3 months after the program

\*: Statistically significant at  $p \leq 0.05$

Table (4) clarifies nurses' performance for reducing light through phases of developmental supportive care program. It was clear that only 4% of nurses covered incubator (use eye cover) to protect preterm neonates from light. This percentage increased to 42% immediately after program application and 32% three months after the program application with statistical significant difference ( $p = <0.001$ ). The same table also clarifies that all nurses (100%) used eye cover during focused lighting medical procedures before, immediately after the application of the program and three months later. None of the nurses used their hand during focused lighting medical examinations to cover the eye before the program, immediately after the application of the program and three months later. Concerning the vision, it was obvious from the same table that all the nurses did not place strongly contrasting images in preterm neonates view before the program, immediately after the application of the program and three months later.

**Table (4): Nurses' Performance for Reducing Light through Phases of Developmental Supportive Care Program**

Content of Developmental Supportive Care Program	Before program				Immediately after program				3 months after program				P
	Not performed n=50		Performed n=50		Not performed n=50		Performed n=50		Not performed n=50		Performed n=50		
	No	%	No	%	No	%	No	%	No	%	No	%	
<b>3.Reducing light and vision.</b>													
<b>a)Light</b>													
1. Use eye cover to protect preterm neonates from light.	48	96.0	2	4.00	29	58.0	21	42.0	34	68%	16	32.0	<0.001*
2. Use eye cover during focused lighting medical procedures	0	0.0	50	100	0	0.0	50	100	0	0.0	50	100	-
3. Use nurse's hand during focused lighting medical procedures/examinations to cover the eye.	50	100	0	0.0	50	100	0	0.0	50	100	0	0.0	-
<b>b) Vision</b>													
1. Do not place strongly contrasting images in preterm neonates view	0	0.0	50	100	0	0.0	50	100	0	0.0	50	100	-

p: p value for **Friedman test** for comparing between before and Immediately after, 3 months after the program

\*: Statistically significant at  $p \leq 0.05$

Table (5) clarifies nurse's performance for reducing stress through phases of developmental supportive care program. Concerning containment, it was observed from the table that none of the nurses placed their hand gently on the preterm neonates' head and feet while providing flexion. This percent increased to 92% immediately after application of the program with slight decrease to 88% three months later with statistical significant difference ( $p = <0.001$ ).

Regarding non-nutritive sucking, the same table showed that one third of nurses (30%) applied the NNS before painful procedures. This percent increased to more than half of them (62%) immediately after

application of the program with a slight reduction to 46% three months later with statistical significant difference ( $p < 0.001$ ).

Before starting the program, it was clear that more than one third of nurses (38%) applied the NNS when the preterm neonates were awake. This percent increased among around half (56%) of them immediately after application of the program, but it slightly declined to 46% three months later with statistical significant difference ( $p < 0.001$ ).

**Table (5): Nurses' Performance for Reducing Stress through Phases of Developmental Supportive Care Program**

Content of Developmental Supportive Care Program	Before program		Immediately after program		3months after program		P						
	Not performed n=50	Performed n=50	Not performed n=50	Performed n=50	Not performed n=50	Performed n=50							
	No	%	No	%	No	%							
<b>a) Containment</b>													
1. Place the hand gently on the preterm neonate's head while doing flexion and containment (hand swaddling).	50	100	0	0.0	4	8.0	46	92.0	6	12.0	44	88.0	<0.001*
2. Start containment before painful procedure.	50	100	0	0.0	4	8.0	46	92.0	4	8.0	46	92.0	<0.001*
<b>b) Non-nutritive sucking (NNS)</b>													
1. Apply the (NNS) before painful procedures	35	70.0	15	30.0	19	38.0	31	62.0	27	54.0	23	46.0	<0.001*
2. Apply the (NNS) when the preterm neonates awake	31	62.0	19	38.0	22	44.0	28	56.0	27	54.0	23	46.0	0.009*
3. Use the pacifier	33	66.0	17	34.0	19	38.0	31	62.0	27	54.0	23	46.0	<0.001*
4. Allow the preterm neonates to suck for as long as they wish	31	62.0	19	38.0	23	46.0	27	54.0	29	58.0	21	42.0	0.013*

p: p value for **Friedman test** for comparing between before and Immediately after, 3 months after the program

\*: Statistically significant at  $p \leq 0.05$

Table (6) shows nurses' performance of kangaroo care through phases of developmental supportive care program. It was obvious that only 4% of nurses explained technique of kangaroo care to the mother before the program. This percent reached 80% of nurses immediately after program application, but it declined to half (50%) three months later with statistical significant difference ( $p < 0.001$ ).

Only 4% of nurses picked the preterm neonates up and placed them on the chest of their parent, with legs and arms in a flexed position and head to one side before the program. While, 80% of them performed it immediately after the program application. Meanwhile, this percent decreased to 50% of them three months later. This difference was statistically significant ( $p < 0.001$ ).

It was observed from the same table that none of nurses ended the session of kangaroo care preterm neonate showed signs of distress i.e. apnea, desaturation, bradycardia or color change before program, immediately and three months after the program application.



**Table (6): Nurses' Performance of kangaroo Care through Phases of Developmental Supportive Care Program**

Content of Developmental Supportive Care Program	Before program		Immediately after program				3 months after program				P		
	Not performed n=50		Performed n=50		Not performed n=50		Performed n=50		Not performed n=50			Performed n=50	
	No	%	No	%	No	%	No	%	No	%		No	%
<b>5-Kangaroo care</b>													
<b>Mother Preparation</b>													
1. Explain technique of Kangaroo Care to the mother.	48	96.0	2	4.0	10	20.0	40	80.0	25	50.0	25	50.0	<0.001*
2. Provide privacy for the mother.	48	96.0	2	4.0	10	20.0	40	80.0	25	50.0	25	50.0	<0.001*
<b>Preterm neonate preparation:</b>													
1- Remove preterm neonates' clothes except the nappy	48	96.0	2	4.0	10	20.0	40	80.0	25	50.0	25	50.0	<0.001*
2- Sit the parent comfortably and ask them to open their clothes.	48	96.0	2	4.0	10	20.0	40	80.0	25	50.0	25	50.0	<0.001*
3- Pick preterm neonate up and place him/her on the chest of the parent, with legs and arms in a flexed position and head to one side.	48	96.0	2	4.0	10	20.0	40	80.0	25	50.0	25	50.0	<0.001*
4- Cover preterm neonate with blanket and apply hat to maintain body temperature.	48	96.0	2	4.0	23	46.0	27	74.0	35	70.0	15	30.0	<0.001*
5- End the session of kangaroo care if preterm neonate shows signs of distress i.e. apnoea, desaturation, bradycardia or colour change	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	-

p: p value for **Friedman test** for comparing between before and Immediately after, 3 months after the program

\*: Statistically significant at  $p \leq 0.05$

Table (7) illustrates the distribution of nurses according to their total percent scores of performance regarding developmental supportive care through program implementation phases. It was obvious that none of the nurses obtained good score related to developmental supportive care before program. On other hand, three quarters (74%) of them had good total score of developmental supportive care immediately after the program. Unfortunately, this percent decreased to 42% three months later. There were statistically significant difference between nurses' performance scores regarding developmental supportive care before, immediately after the application of the program, and three months later ( $p = <0.001$ ).

**Table (7): Distribution of Nurses According to their Total Percent Scores of Performance Regarding Developmental Supportive Care through Program Implementation Phases**

Total Percent Scores of Nurses Performance of Developmental Supportive Care through Program	Before program n=50		Immediately after program n=50		3 months after program n=50		P
	No	%	No	%	No	%	
Good	0	0.0	37	74.0	21	42.0	<0.001*
Satisfactory	6	12.0	5	10.0	6	12.0	
Unsatisfactory	44	88.0	8	16.0	23	46.0	

p: p value for F test (**ANOVA**) with repeated measures for comparing between different period

\*: Statistically significant at  $p \leq 0.05$

### V. Discussion

Prematurity is an increasing global perinatal challenge. Recently based on advancement in perinatology and neonatology, survival rate for preterm neonates have dramatically increased. However, the increased survival rate in this group of neonates has not been matched by a reduction in disability rate due to early disruption of intrauterine life and sudden exposure to entirely unfamiliar NICU environment<sup>(24)</sup>. To reduce developmental dysfunctions in preterm neonates, neonatal care giving needs to be modified to support these neonates' brain, social, and emotional development during hospitalization<sup>(25)</sup>. Developmental supportive care for preterm neonates relies greatly on the education and training of NICU nurses. Structured teaching program regarding developmental supportive care for preterm neonates can improve quality of nursing care in NICU<sup>(26,27)</sup>.

Postures support and positioning aim to provide optimal physiological, neurological and musculoskeletal development for the preterm neonates<sup>(28,29)</sup>. As regards side lying supporting position of preterm neonates, the findings of present study revealed that significant changes were noted in nurses' performance concerning side-lying supported position where the majority of them supported back and head in midline with bending legs at the hips immediately after program application and three months later. This could be attributed to the impact of program application and keeping a booklet in NICU which reminds nurses for appropriate position. These findings are in harmony with Betts et al (2015) who emphasized that the proper supportive side lying position by supporting the back and head in midline and bending the legs at the hips should be supported to prevent hyper-extension of the legs<sup>(23)</sup>.

The present study revealed that a small percentage of nurses supported soles of feet of preterm neonates by the nest in side-lying position before the application of the program. This could be justified by lack of hospital supplies required for nesting and lack of information about developmental supportive care. Meanwhile, the highest percentage of nurses applied support soles of preterm neonates' feet by the nest immediately after program application and three months later. This finding may be due to nurses' awareness of nesting method and provision of NICU by multiple nests with different sizes. This finding is supported by Hunter et al (2015) who reported that education is effective in improving developmental positioning proficiency of NICU nurses, as well as improving consistency in positioning. Moreover, forming a "nest" with soft boundaries, as well as a padded foot-roll for foot-bracing, provide postural, behavioral, and physiological stability to the preterm neonate<sup>(28)</sup>. In addition, Zarem el al (2013) mentioned that nest requires little effort by the nurse and provides effective and developmentally supportive care positioning<sup>(30)</sup>.

Caring of preterm neonates in supportive supine position requires maintaining them in midline position and providing nests/boundaries especially for the feet support and the arms-allowing for the arms/hands to be brought towards the face. The current study showed that the majority of nurses did not support head of preterm neonates in the midline (chin in line with sternum) by using rolled towel before program application. A statistical significant difference was found immediately after the application of program and three months later. These findings could be justified by the nurses' performance were improved after the program implementation. Moreover, the program increases nurses' knowledge about the importance of keeping the head of neonates in midline in supine position to promote cerebral blood flow in preterm neonates. These findings are in harmony with Elser et al (2012) who mentioned that midline head position promotes cerebral blood flow and when preterm infants' heads were turned to the right or left, blood flow was lower than in a midline head position<sup>(31)</sup>.

Developmental supported prone position must be well maintained, as gravity will push the knees out to the sides. It increases time spent in quiet sleep, saves energy and helps faster weight gain<sup>(32)</sup>. The present study showed a statistical significant difference in nurses performance regarding keeping the spine straight, not curved to the right or left, and the back rounded. These findings could be interpreted by that nurses recognized the importance of proper prone position to promote proper joint alignment and symmetry, it supports neuromuscular development, and promotes self-soothing and behavioral. In this context, Lucas et al (2015) mentioned that maintaining the correct prone posture is important as muscle tone is still developing until 36 weeks; it helps in ex-utero movement development, prevents postural deformities and helps self-consoling<sup>(33)</sup>.

Sound plays an important role in the emotional and auditory development of infants. The unwanted sound in the NICU environment is characterized by unpredictable, disruptive, and physiologically stressful noise. Although noise in the NICU cannot be eliminated yet, environmental design and modifications can facilitate noise reduction. The present study clarified a significant change regarding nurses' closing the incubator doors softly, immediately after the program application and three months later. The finding of the current study is in harmony with Harigopal (2014) who emphasized that closing the incubator doors softly is one of the basic elements in reducing of noise in NICU<sup>(34)</sup>.

The current study also revealed that a significant change was noted related to setting alarms and phones at the lowest safe level by nurses immediately after program application and three months later. While, it was observed that only around half of nurses performed it immediately after program application and three months later. This could be justified by lack of legislation regarding noise in NICU, and lack of supervision. These findings are in agreement with Philbin et al (2002) who studied the implementation of a noise reduction program in NICU and observed temporary change of attitude in health care professionals<sup>(35)</sup>. These findings also are supported by Valizadeh et al (2013) who found that nurses in NICU turned off the alarms immediately to avoid unnecessary alarm noises<sup>(27)</sup>. Generally, the educational program dramatically improved nurses' performance about reducing the noise which highlights nurses' acceptability in terms of knowledge and practice.

The findings of current study revealed that less than half of nurses used eye cover to protect preterm neonates from light. These could be attributed to the fact that covering neonates' eye reduces exposure to the stress of light. The finding of the present study is supported by Valizadeh et al (2013) who mentioned that nurses applied eye cover as the general policy of providing a supportive environment in NICU<sup>(27)</sup>.

Non-nutritive sucking is a benign intervention. It can have calming effect and improves the development of sucking behavior of preterm neonates. The findings of the present study showed that nearly one

third of nurses applied the non-nutritive sucking using pacifier before painful procedures. The findings of the present study reflected that more than half of the nurses' performance of NNS was much better immediately after the program application and three months later. These could be explained in the light of raising nurses' awareness of the benefit of nonnutritive sucking to decrease stress of preterm neonates after program application. These findings are in agreement with Betts et al (2015) who developed evidence –based guideline for developmental care of preterm neonates and recommended NNS as a soothing effect on preterm neonates before painful procedures<sup>(23)</sup>.

Containment is developmentally sensitive, non-pharmacological comfort measure that can relieve procedural pain and also calm an unsettled infant<sup>(23)</sup>. The current study recognized that there was a statistically significant difference between nurses' performance regarding the containment immediately after the program application and three months later. This could be explained by nurses recognized that containment is a simple way to calm the preterm neonates. These results are in agreement with Altimier (2015) who mentioned a statistically significant increased nursing practices' score related to minimizing stress and pain after training of nurse on developmental care of preterm neonates<sup>(36)</sup>.

Neonatal nurses play a pivotal role in facilitating the attachment process by promoting early parent-infants contact. Parents should be encouraged and supported to have their infants in kangaroo care position regularly and consistently<sup>(37)</sup>. The findings of the current study reflected that the majority of nurses' performed kangaroo care immediately after the program. A decline in such performance was recognized three months later. The previous findings could be interpreted by the training program enhanced nurses' performance immediately after its application. While after three months, the decline of such performance could be explained by lack of motivation from physicians who should order the kangaroo care as a part of neonatal care. Also, they need continuous supervision from the nurse manager to ensure practicing of KC. These findings are consistent with Hendricks-Munoz et al (2014) who reported that comprehensive simulation-based KC education program improved nurses' perception of KC value and their competency regarding KC for the preterm neonates in the neonatal intensive care unit<sup>(38)</sup>. In addition, Adzitey et al (2017) reported that NICU nurses are in need for creating a training opportunities and regular in-service training to enhance their knowledge regarding KC and its benefits for its successful implementation<sup>(39)</sup>.

The findings of current study revealed that the majority of nurses had unsatisfactory score regarding developmental supportive care before the program application, while this score of performance was highly improved immediately after program application and three months later with statically significant difference. These findings could be attributed to provision of nurses with supplies that facilitate nurses to perform developmental supportive care such as nests and towel, head, and eye covers. In addition, the program improved nurses' practice by demonstration and motivation. The findings of present study are supported by Liaw et al (2009) who mentioned that nurses' performance was more supportive during post-training of developmentally supportive care, and training programs help nurses to implement developmental care for preterm neonates<sup>(40)</sup>. The current study is in the line with Altimier et al (2015) and Symington et al (2006) who reported that the Wee Care program improves staff satisfaction and engagement in care<sup>(36,41)</sup>.

## **VI. Conclusion**

Based on the previous findings, the current study concluded that nurses had good total score of performance regarding developmental supportive care immediately after the application of the program and this total score declined three months after program application.

## **VII. Recommendations**

Based on the previous findings, the following recommendations are suggested:

- Neonatal intensive care units should include updated policies related to developmental supportive care for preterm neonates.
- Neonatal intensive care nurses must be encouraged to attend refreshing courses and workshops regarding updated theoretical and clinical aspect of developmental supportive care for preterm neonates.
- Neonatal intensive care units should have developmental supportive care committee responsible for providing knowledge, in-service training, and mentoring nurses' performance of developmental supportive care for preterm neonates.
- Proper pre-service training for newly recruited nurses and in-service training program for nurses about the most recent developmental supportive care interventions for preterm neonates guidelines are mandatory to update their knowledge and improve their performance about developmental supportive care.

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