

The Effect of Developmentally Supportive Care Training Program on Nurses' Performance and Behavioral Responses of Newborn Infants

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Abstract

Developmental care is a strategy used in neonatal intensive care units (NICUs) to help reduce the amount of stress that a newborn infant is exposed to. Developmental care helps NICUs to be more "baby friendly". The aim of the current study was to examine the effect of developmentally supportive care training program on nurses' performance during tub bath provided for neonates in NICU, and to explore the effect of developmentally supportive care training program on behavioral responses of newborn infants during tub bath in NICU. The study adopts a quasi-experimental research design. The study was conducted in the NICU at Benha Specialized Pediatric Hospital. The data were collected using structured interview sheet, newborn assessment sheet, Neonatal Behavioral Assessment Scale developed by Brazleton and Nugent (1973) and an observational checklist to evaluate the nurses' performance during tub bath. Apparently, the study results evident that there was highly statistically significance differences between the means of the total scores of nurses' performance regarding tub bath for newborn infants before and after application of developmentally supportive care program (DSC). Moreover, the means of NBAS items were all significantly improved among newborn infants and they exhibited less stress and greater comfort during tub bath after application of DSC program. The study recommended that collaboration and continuing education of the staff in the NICU are vital to improve the quality of care provided for newborn infants.

Keywords: Developmentally supportive care-Nurses' performance- Behavioral responses of neonates

1-Introduction

Admission of the newborn infants to the NICU means being exposed to a series of painful and stressful stimuli for which it is not prepared. These stimuli will not only trigger acute responses, but will also affect the structure and function of their immature brain and, consequently, subsequent neurodevelopment. Consequently, different attempts have been made to reduce the negative impact of potential harmful stimuli (*Solhaug, Bjork & Sandro, 2010*).

Developmental care (DC) has been described as a pervasive orientation of all health care procedures toward maintaining the newborn infant in organized or stable a condition as possible and managing the physical care and social environment to minimize stressors. Practice of DC introduced in the 1980s as a model of care aimed at minimizing the adverse effects of the NICU environment on high-risk infants (*Laing, Spence, McMahan, Ungerer, & Badawi, 2012; Bird, 2012*). This practice is a paradigm shift in NICU care, bringing the infants' individual developmental needs and caretaking practices in alignment with physiologic needs, to support the infants' growth and development. DC is a comprehensive transformation of the NICU environment promoting the infants' comfort, growth, and development (*Ludwing, Steivhen, Khoury & Krieg, 2008*).

The developmental care principles consist of four standards; individualize care, providing a supportive environment for development, supporting family and continuity of care. Its philosophy consists of newborn infants and family support, staff and family relation and the general policies in NICU. This principal emphasizes on concepts such as emotional care, family centered care, parents participation in care and decision making for newborn infant, meticulous care with the emphasis on infant's reaction, ensure enough sleep, minimal invasive and painful actions, pain management, team work and coordination. In DC, the aim is to provide an environment with a structure which supports, promotes and guides the development of newborn infant, so the infant and the family experience the least vulnerability (*Valizadeh, Asadollahi, Mostafa, Gharebaghi, & Gholami, 2013*).

Developmentally supportive care (DSC) is recognized the newborn infant as a human being in his or her own right and encourage the caregivers to be guided by the current needs of the newborn infant and family. Care and intervention based on the infant's own behavior make good biologic sense and are attractive from an ethical point

of view (Mercer, 2009). DSC recognized as an essential attribute of high-quality neonatal and family care. Infants and families who must traverse the NICU deserve the quality of care that this care giving philosophy demands (McGrath, Samra & Kenner, 2011). DSC is mandatory for the optimal development of the newborn infant (Arizona Department of Health Services, 2007).

Developmentally supportive care involves a combination of multiple philosophies and numerous intervention techniques all focused on the infant as the central figure in the NICU. These strategies are aimed at increasing the infants' comfort and reducing stress in an individualized manner from admission through discharge. These include, but are not limited to, developmentally supportive positioning and handling, recognizing and responding to infant cues, clustering of care and procedures to promote rest, and offering nonnutritive sucking for self-regulation and pain management. Light and sound are adjusted according to the needs of the infant in addition to the needs of the staff (Hunt, 2011).

Nursing in today's climate relies heavily on evidence-based practice and with such new concepts implementing change in practice (Hall, 2008). Nurses have been found to be less likely to incorporate research-related behaviors into practice if short-staffed and time-pressured (Laing et al., 2012). Valizadeh et al. (2013) summarized that according to Florence Nightingale, the origins of DC can be found in the principles of nursing and nurses responsibility in creating and maintaining an appropriate environment to improve the process. Maguire and Veen (2008) highlighted that a successful DSC program is the product of a multidisciplinary team of parents, nurses, nurse practitioners, physicians, occupational/physical therapists, administrators, architects, engineers, and social workers. It requires a paradigm shift of attitudes regarding ownership of an infant's care and the personhood of the newborn patients. DSC in the NICU is defined by efforts in unit design, equipment selection, policies, care protocols, and staff training to maintain the basic physical, sensory, and interpersonal needs of the preterm infant while minimizing exposure to noxious and painful stimuli. The history of DC is rooted in the fields of neonatal nursing and physical/occupational therapy.

2-Significance of the Study

Developmentally supportive care is endorsed by researches from several scientific fields, including neuroscience, developmental and family psychology, medicine and nursing. In recent years, research examining the effectiveness of individualized, developmentally supportive care to newborn infants in the NICU has demonstrated a variety of positive effects. It significantly improved medical outcomes, including reduced dependence on respiratory support, improved weight gain, earlier accomplishment of nipple feedings, shortened lengths of stay, and reduced costs of care.

However, researches addressing nursing staff experience during implementation of DC are limited. Even fewer studies focus on staff experience of DSC in particular. However, despite a growing body of evidence for DC practices, implementation has varied among institutions and widespread adoption has not been achieved. As far as we are aware, there have been few previously reported studies evaluating individualized, developmentally directed care in NICU context. Hopefully, the current study would provide a developmentally supportive approach that could improve the quality of nurses' performance as well as decrease the newborn infants' stress in NICU.

3-Aim of the Study:

The aim of the current study has two folds:

1. To examine the effect of developmentally supportive care training program on nurses' performance during tub bath provided for newborn infants.
2. To explore the effect of developmentally supportive care training program on behavioral responses of newborn infants during tub bath.

4-Research Hypothesis:

The following hypotheses were tested:

- Nurses who received developmentally supportive care training program will had higher performance score during tub bath than before.
- Newborn infants who were bathed by nurses received developmentally supportive care training program would exhibit less stress-related behaviors.

5-Subjects and Methods

5-1-Research Design:

The current study utilized a single-group pretest and posttest quasi-experimental design. The variables observed before and after the DSC training program, were nurses' performance and newborn infant's behavioral response during tub bath.

5-2-Setting:

The study was conducted in the NICU at Benha Specialized Pediatric Hospital.

5-3-Sample:

The study sample consisted of 40 newborn infants and 40 nurses on different days. Nurses should not be attending other education programs related to DSC during the study period. The researchers employed a convenience sampling to select all nurse participants and newborn infants who met the study criteria. Newborn infants who participated in the study were selected according to the following criteria:

- Full term neonates (38-42 weeks of gestation)
- Their ages after birth between 10 and 20 days
- Newborn with umbilical cord fell off
- Newborns that had no severe medical or metabolic conditions (such as pharmacological treatment with sedatives or short-acting/long-acting skeletal muscle relaxants)
- Newborns that had no neurological anomalies or neonatal seizures at birth.

5-4-Ethical consideration:

All nurses and newborn infants' parents were informed about the aim of study, its benefits, in order to obtain their acceptance to participate. The researchers informed them that the participation in the study is voluntary; they have the right to withdraw from the study at any time, without giving any reason and that their responses would be held confidentially.

5-5-Data Collection Tools:

The following instruments were utilized to collect the required data:

1. **Structured Interview Sheet:** developed by the researchers after extensive review of related literatures. It involve 7 items related to sociodemographic data about nurses such as age, level of education, years of experiences, attendance of training programs about DSC. It also composed of 10 questions to assess nurses' knowledge about DSC, as definition, purposes, benefits and application of DSC. Finally, it included 8 questions covered the nurses' reactions toward the DSC.
2. **Newborn infant's assessment sheet,** developed by the researchers. It involve data extracted from each newborn's medical file and nurses' notes such as, gestational age, gender, birth weight, head circumference, length, diagnosis, etc.....
3. **Neonatal Behavioral Assessment Scale (NBAS):** NBAS designed by Brazleton and Nugent (1973). It was designed to assess full-term babies from 37-42 weeks' gestation. The scale describes the newborn's strengths, adaptive responses and possible vulnerabilities. It produces a total of 53 items, of which 28 are behavioral items grouped under the following: habituation, which includes 4 items related to response to light, bell, and tactile stimulation; social-interactive which involves 7 items about animate and inanimate visual, auditory orientation items, and alertness; state of organization which includes 4 items assess the peak of excitement, and irritability. Motor and autonomic systems groups which includes 10 items to assess muscles tone, motor maturity, pull-to-sit, defensive movements and level of activity, tremors, startles and skin color, and state of regulation which includes 4 items related to cuddliness, consolability, self-quieting activity and hand-to-mouth activity. The scale involved another 7 supplementary items pertinent to alertness and attention. The reminder 18 items measure a variety of areas such as reflexes, responses to stress, startle reactions. The consequential validity of the NBAS scale has been very favorable, providing a considerable research base. The behavioral items, including the supplementary items, are scored on 1-9-point scales, where 9 means a very high level of functioning and 1 a very low level of functioning and reflexes are scored on a 4-point scale. The result is not a score, but instead an understanding of how newborn infants integrate these areas as they adapt to their new environment. It shows the newborn's individual ability to habituate to sound, light and touch, to interact and to self-comfort, and self-regulate.
4. **An observational checklist** to evaluate nurses' performance during newborn' tub bath procedure. It adopted from Hockenberry and Wilson (2011) and modified by the researchers by adding DC principles and strategies such as positioning and handling, control of light and noises, using toy and nonnutritive sucking. It composed from 32 items covered the following areas: preparatory steps for tub bath (3 items); implementation of DC principles and strategies during tub bath (8 items); perform the steps of tub bath procedure (18 items) and implementation of post tub bath steps (3 items).

Scoring system: for knowledge; each correct response took two scores, the incomplete one took one score and the wrong answer or the not known response took no score with a total score of 20 represent 100%. As regards nurses' performance, each completely done step of tub bath procedure took two scores, the incomplete one took one score and the not done step took no score with a total score of 64 represent 100%.

The developmentally supportive care training program

The intervention was a training program developed by the researchers after extensive review of related literature. The training program was designed for neonatal nurses, which emphasized the application of DSC. The content of the training program included four sections of presentations (characteristics of newborn infants, newborn infant behavioral cues, and DC and nurses' role in application of DSC [tub bath]). Various DSC strategies were utilized such as positioning, lighting, noise control, nonnutritive sucking as well as visual, auditory, tactile, and olfactory, gustatory and vestibular stimulation. DSC training program included illustrated Arabic booklet involve instructions to improve nurses' knowledge in assessing newborn infant's behavior and in applying DSC to care giving practice during tub bath.

5-6-Validity and Reliability

The data collection tools were revised by a panel of five experts in the field of pediatric nursing and neonatal medicine to test the content validity. According to their review few modifications were carried out in the content. Regarding reliability, the reliability coefficients' alpha between questions was 0.719.

5-7-Data Collection Procedure

A permission to carry out the study was obtained from the official personnel in NICU and simple explanation was given to them about the nature of the study, its aims, benefits and study tools. Acceptance from nurses and each newborn's mother\ father were obtained. The interview conducted for all nurses to fill the sociodemographic sheet and to assess nurses' knowledge about DC on individual bases. Data related to the newborn infants such as their gestational age, weight, head circumference, length, diagnosis, etc... were extracted from the newborn's medical file and nurses' notes.

In the current study, nursing performance is confined to all nursing activities that need to be offered to newborn infants during their tub bath. Bathing activity is less intrusive, easy to observe, and considered as a very important routine nursing care in neonatal units. Therefore, tub bath was selected as the observation situation for the current study.

The contents of the training program were given over 4 sessions; characteristics of newborn infants, newborn infant behavioral cues, and DC and nurses' role in application of DSC (tub bath procedure). The total number of nurses has been divided into 6 groups, each group containing from 5 – 8 nurses according to their work schedule. The application of the training program was given over two days per week during the morning and afternoon shifts. The bathing procedure was performed by the nurse in charge of the neonate at the time of the procedure. Before the implementation of DSC training program, newborn infants were cared for as per existing standards of care. The policies at that time did not include DSC, noise, and light reduction levels or positioning. Both nurses and newborn infants underwent evaluation before and immediately after the DSC training using observational checklists.

After the implementation of DSC training program, the nurses' knowledge was evaluated as a post-test. Newborn infants were bathed using the principles of DSC taught in the training program. The bathing procedure was performed using the principles of DSC by the nurse at the time of the procedure for three consecutive days. All newborns were observed during tub bath procedure to document their behaviors based on NBAS, it measured by the researchers with assistance of the assigned neonatologist. Nurses' performance and newborns' behaviors were evaluated three times after application of the DSC training program using observational checklist. Nurses' performance and newborn infant behaviors were measured from the time that a nurse put her hands on the newborn infant to the stage when she completed the bath and removed her hands and left. The assessment of each nurse's performance and newborn's behaviors during tub bath took 25-35 minutes. Data collection started from the beginning of January to the end of August 2013.

5-8-Pilot Study

The pilot study on 10% of newborn infants (four full term newborn infants) and 10% of nurses (four nurses) was done to test the study tools in terms of clarity, time required to be applied. No items were modified according to nurses' responses in the pilot study. The sample involved in the pilot study was included in the whole study sample.

6-Statistical analysis of data:

The collected data were categorized, tabulated, and analyzed using the SPSS computer program Version 15. Numerical data were expressed as mean and standard deviation. Qualitative data were expressed as frequency and percentage. Chi-square was used to detect the difference between nurse's knowledge and performance before and after DSC training program. Comparison of means was performed using paired-sample t-test and F-test. Correlation among variables was done using Pearson correlation coefficient. Level of significance at $p < 0.05$, 0.001 were used as the cut of value for statistical significance.

7-Results

As regards sociodemographic characteristics of the nurses, table (1) revealed that more than half (57.5%) of

them their age ranged from 20 to less than 30 years, the mean of their age was 28.01 ± 4.5 year. More than two thirds of them were graduated from secondary school of nursing. The highest percentage of them (72.5%) working as bedside nurse and 80% had more than three years of experience in caring of newborn infants.

Concerning the characteristics of newborn infants, the current study results highlighted that 50% of them were males and the other half were females and 60% of them had gestational age ranged 40-42 weeks of gestation. The mean of their weight was 3235.10 ± 461.98 gm, and 49.20 ± 3.75 cm for length and 35.20 ± 1.92 cm was the mean of their head circumference. Regarding to their diagnosis, it was found that the highest percentage (40%) of them had neonatal jaundice, followed by 30% suffered from gastrointestinal tract (GIT) congenital anomalies such as duodenal atresia and cardiac anomalies such as ventricular septal defect (VSD). Twenty percent of them complained from respiratory distress (table 2). Apparently, table (3) proved that there were highly statistically significance differences (P value is $<.001$) between all items of nurses' knowledge about developmental care during pre and post DSC program application.

Regarding to nurses' reactions toward application of DSC program, it was evident from table (4) that all of nurses (100%) reflected that DC is useful for the newborn infant and it helps the nurse to feel more confident. Moreover, the vast majority (95%, 95%, 92.5%, 87.5% & 85% respectively) of them agree that DC program met their professional needs, help them in controlling newborn infant's behaviors, met the emotional needs of the newborn infant, makes the baby to become better than before and allow nurses to detect any observations on the newborn infant. Furthermore, 82.5% of nurses preferred to apply the developmental care strategies during their routine nursing activities in the NICU.

Table (5) indicated that the mean of the total score of nurses' knowledge before program implementation was 12.3 ± 4.4 increased to 18.0 ± 2.4 immediately after program implementation. The same table confirmed that there was highly statistically significant difference between the mean of the total score of nurses' knowledge regarding developmental care ($p < .001$).

Clearly, table (6) demonstrated that there were highly statistically significance differences (P value= $<.001$) between all steps of nurses' performance regarding implementation of DSC based tub bath for newborn infants. The differences were found between the nurses' performance before program application and during the three consecutive times, which the newborn's tub bath was done after program application.

It was evident from table (7) that the total mean scores of nurses' performance were significantly higher whether in the first, second and third post-test compared to the pre-test. On the same context, there was statistically significant difference between the means of the total scores of nurses' performance regarding tub bath both in the pre-test and the three post-testes times ($p = <.001$).

In relation to the assessment of the newborn infants' behaviors during tub bath before and after application of DSC program, it was clear from table (8) that the means of NBAS items were all significantly improved. Especially those items concerned with the habituation items as (decreased response to sources of noises), motor system activities such as (improved general motor tone, decreased tremors, fussing etc...), state of organization (decreased irritability and excitement), state of regulation e.g. (consolability and cuddliness) and reflexes (improved sucking reflex). The improvement in the newborn' behaviors became apparent after repeated infant bath for the second and third time after application of the principles and strategies of DC. There was statistically significant difference between the means of the total scores of NBAS items during tub bath both in the pre-test and the three consecutive post-testes ($p = <.001$).

The current study results revealed that there was no statistically significant correlation between nurses' level of knowledge and performance and their age, level of education, years of experience and job titles ($p = <.05$). As regards the correlation between newborn infants' NBAS scores and their characteristics, it was found that there were statistically significant correlation between newborn infants' NBAS items particularly those concerned with habituation, social-interactive and reflexes items and their gender, girls showing higher levels of functioning than boys ($p = <.05$). On the other hand, there was no statistically significant correlation between newborn infants' NBAS scores and their diagnosis ($p = >.05$).

Table (1): Percentage Distribution of Nurses' Sociodemographic Characteristics (n=40).

Sociodemographic characteristics	NO.	%
Nurses' age/ years:		
- 20-<30	23	57.5
- 30-<40	17	42.5
Mean± SD	28.01 ± 4.5	
Level of education:		
- Secondary school nursing diploma	27	67.5
- Technical institute of nursing	3	7.5
- Bachelor degree of nursing	10	25
Job title:		
--Bedside nurse	29	72.5
- Nurse supervisor	8	20
- Head nurse	3	7.5
Years of experience:		
-<1 year	2	5
-1-<3 years	6	15
-> 3years	32	80

Table (2): Characteristics of Newborn Infants in Percentage Distribution (n= 40)

Items	NO.	%
Newborn's gender:		
-Male	20	50
-Female	20	50
Gestational age:		
-38-less than 40 weeks	16	40
-40-42 weeks	24	60
Diagnosis:		
-Neonatal jaundice	16	40
-Congenital anomalies (gastrointestinal tract and cardiac)	12	30
-Respiratory distress	8	20
-Meconium aspiration syndrome	2	5
-Neonatal sepsis	2	5
Mean ± SD		
Newborn's weight (gm)	3235.10 ± 461.98	
Newborn's length (cm)	49.20 ± 3.75	
Newborn's head circumference (cm)	35.20± 1.92	

Table (3): Percentage Distribution of Nurses' Knowledge regarding to Developmental Care (n=40).

Items	Pre-DSC program		Post-DSC program		X ²	P-value
	NO.	%	NO.	%		
Definition of DC:						
-Complete	2	5	32	80	49.952	<.001
-Incomplete	19	47.5	8	20		
-Don't know	19	47.5	0	0		
Aim of DC:						
-Complete	3	7.5	37	92.5	46.76	<.001
-Incomplete	27	67.5	3	7.5		
-Don't know	10	25	0	0		
Components of DC:						
-Complete	4	10	37	92.5	54.722	<.001
-Incomplete	28	70	3	7.5		
-Don't know	8	20	0	0		
Application of DC in nursing procedures:						
-Complete					69.241	<.001
-Incomplete	0	0	35	87.5		
-Don't know	26	65	5	12.5		
	14	35	0	0		
Responsible persons for application of DC:						
-Correct	8	20	38	95	46.06	<.001
-Incorrect	30	75	2	5		
-Don't know	2	5	0	0		
Factors affecting DC:						
-Complete	9	22.5	40	100	45.635	<.001
-Incomplete	25	62.5	0	0		
-Don't know	6	15	0	0		
Strategies for effective application of DC:						
-Complete					50.61	<.001
-Incomplete	9	22.5	40	100		
-Don't know	8	20	0	0		
	23	57.5	0	0		

*DC=Developmental care

Table (4): Percentage Distribution of Nurses' Reactions toward Application of the Developmental Care after Program Implementation (n=40).

Nurses' Reactions	Yes		NO	
	NO.	%	NO.	%
DC is useful for the newborn infant	40	100	0	0
The nurse feel more confident after application of DC	40	100	0	0
DC program met my professional needs n the field of neonatal nursing	38	95	2	5
DC strategies help the nurse to detect some new behaviors and observations upon the newborn infant	34	85	6	15
The newborn infant exhibit better behaviors after application of DC strategies	35	87.5	5	12.5
DC strategies help the nurse to control the newborn's behaviors	38	95	2	5
DC strategies met the emotional needs of the newborn infant	37	92.5	3	7.5
Prefer the application of DC strategies constantly	33	82.5	7	17.5

Table (5): Comparison between the Mean of the Total Score of nurses' Knowledge regarding Developmental Care

Items	Pre-test	Post-test	t	P
	Mean ± SD	Mean ± SD		
Total knowledge	12.3 ± 4.4	18.0 ± 2.4	12.386	<0.00

Table (6): Percentage Distribution of Nurses' Performance during Tub Bath through Program Implementation Phases (n=40)

Items	Pre-test		Post-test 1		Post-test 2		Post-test 3		X ²	P
	NO.	%	NO.	%	NO.	NO.	NO.	%		
Explaining the purposes of procedure:										
-Not done	4	10	1	2.5	0	0	0	0	86.17	<0.001
-Done incompletely	34	85	14	35	8	20	0	0		
-Done completely	2	5	25	62.5	32	80	40	100		
Preparation steps before tub bath procedure:										
-Not done	2	5	0	0	0	0	0	1	29.07	<0.001
-Done incompletely	16	40	7	17.5	4	10	1	2.5		
-Done completely	22	55	33	82.5	36	90	39	97.5		
Implementing developmental care steps before procedure:										
-Not done	40	100	2	5	0	0	0	0	197.90	<0.001
-Done incompletely	0	0	26	65	11	27.5	2	5		
-Done completely	0	0	12	30	29	72.5	38	95		
Applying steps of tub bath:										
-Not done	0	0	0	0	0	0	0	0	31.14	<0.001
-Done incompletely	17	42.5	8	20	2	5	2	5		
-Done completely	23	57.5	32	80	38	95	38	38		
Applying steps after procedure:										
-Not done	3	7.5	0	0	0	0	0	0	51.31	<0.001
-Done incompletely	26	65	12	30	7	17.5	2	5		
-Done completely	11	27.5	28	70	33	82.5	38	95		

Table (7): Comparison between the Means of the Total Scores of Nurses' Performance during Tub Bath through Program Implementation Phases.

Items	Pre-test	Post-test 1	Post-test 2	Post-test 3	F	P
	Mean ± SD	Mean ± SD	Mean± SD	Mean± SD		
Total nurses' performance	32.22±11.26	52.28±12.67	58.88±9.72	60.16±3.58	69.58	<0.001

Table (8): Comparison between the Means of the Total Scores of Neonatal Behavioral Assessment Scale Items

NBAS Items	Pre-test	Post-test 1	Post-test 2	Post-test 3	F	P-value
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD		
Habituation	14.82 ± 4.49	23.80 ± 5.67	26.80 ± 2.89	29.10 ± 5.93	65.35	<0.001
Social-Interactive	20.50 ± 5.32	39.00 ± 9.24	46.90 ± 6.18	50.10 ± 7.16	138.31	<0.001
Motor system	18.42 ± 4.48	30.80 ± 3.75	33.90 ± 1.78	36.80 ± 3.32	215.98	<0.001
State organization	16.05 ± 4.94	25.20 ± 4.54	28.00 ± 3.00	30.00 ± 3.53	91.26	<0.001
State regulation	12.30 ± 3.57	22.80 ± 4.61	27.20 ± 2.99	27.60 ± 6.93	89.12	<0.001
Autonomic system	12.17 ± 4.52	24.00 ± 3.13	27.30 ± 2.60	29.50 ± 3.95	180.75	<0.001
Supplementary Items	21.50 ± 6.12	41.60 ± 5.56	46.10 ± 4.30	51.00 ± 6.67	203.82	<0.001
Reflexes	37.10 ± 7.48	39.50 ± 8.23	40.00 ± 1.86	58.75 ± 8.50	80.50	<0.001

8-Discussion

As regards the sociodemographic characteristics of the nurses who participated in the current study, the results evident that more than half of nurses aged from 20 to less than 30 years old. On the same context, a study conducted by *Sunniva, (2009)* who investigated the development of a mutual beneficial partnership in the care of the newborn infants in NICU and found that the nurses' age ranged between 29-44 years.

The highest percentage of nurses was graduated from secondary school of nursing and had more than three years of experience in NICU. This result need deep insight from nursing authorities and stakeholders, it need challenging political efforts to upgrade the nurses' educational level through in-service and on-sight education and training. On contrary, *Valizadeh et al. (2013)* who studied nurses' performance with DC standards in NICU and found that most of nurses (97%) had bachelors' degree and they have experience duration of 9 years in NICU. According to *Rashdan (2008)*, within Egypt, there are three types of nurses: college graduate, technical institute graduate and diploma graduate. The majority of Egyptian nurses are diploma graduates comprising approximately 94% of the available nursing work force. Moreover, the *American Association of Colleges of Nursing (2013)* reported that education has a significant impact on the knowledge and competencies of the nurse clinician, as it does for all health care providers.

Concerning the characteristics of newborn infants, the current study results highlighted that half of them were males and the other half were females. On the other hand, the *Egypt Demographics Profile (2012)*, the sex ratio: at birth was 1:05 male/female. Neonatal jaundice is generally considered a benign self-limiting condition, affecting more than 60% of healthy full term and late preterm newborn infants (*Iskander, Gamaleldin & Kabbani, 2012*). The results of the present study were in accordance to the above mentioned empirical evidences and demonstrated that 40% of the studied newborn infants had neonatal jaundice. Nearly one third of newborns in the current study suffered from congenital anomalies particularly GIT and cardiac anomalies. Similarly, several large population based studies place the incidence of major congenital anomalies at about 2–3% of all live births. It accounts for 15–30% of all pediatric hospitalizations (*Shawky and Sadik (2011)*). On the same context, analysis of the available epidemiological data clearly indicates that hereditary disorders and congenital anomalies are rapidly becoming a major public health concern in Egypt. The prevalence of congenital and genetic disorders among infants and young children in Egypt is estimated to range from 2.8% in urban areas in metropolitan governorates to 8.4% in rural areas in Upper Egypt (*Abd-Al Raouf, 2008*). Based on *Egypt Health Profile (2012)*, in Egypt, infant mortality rate due to congenital anomalies is about 15% of all infant deaths (24/1000).

Apparently, the study results proved that there were highly statistically significance differences between all items of nurses' knowledge about DC during pre and post DSC program application. This result indicates the effectiveness of the program on enriching nurses' knowledge regarding DC and its application. So, healthcare professionals should be always encouraged to update their knowledge and maintain clinical competence. Several studies have advocated that DC training enhanced nurses' knowledge and theoretical construct (*Liaw et al., 2009*).

Regarding to nurses' reactions toward application of DSC program, it was evident from the study results that all of nurses reflected that DC is useful for the newborn infant and it help the nurse to feel more confident, met their professional needs, helps them in controlling newborn infant's behaviors and met the emotional needs of the newborn infant. Furthermore, the majority of nurses preferred to apply the developmental care strategies during their routine nursing activities in the NICU. The same explanation was mentioned by *Hendricks-Munoz and Prendergast (2007)* who studied the barriers to provision of DC in the NICU as perceived by 146 neonatal nurses and concluded that, most of nurses (93%) viewed as DC as an essential and beneficial for both newborn infants and nurses. In a recent study conducted by *Mosqueda et al. (2012)* to explore the NICUs staff perception of newborn individualized developmental care and assessment program (NIDCAP) during its implementation and their attitude towards it and intention to put it into practice in two Spanish NICUs. The study concluded that the neonatal unit staff perceived NIDCAP positively but the assessment is more positive for neonatologists than for nurses.

Liaw et al. (2009) studied the neonatal caregiving through a DSC training program on 13 neonatal nurses and 20 newborns and founded that the nursing performance significantly improved after the training. The DSC training programs showed powerful and positive effects on adjusting nursing behavior with regard to the bathing of preterm infants, and the program helped nurses bathe newborn infants with a more gentle and supportive approach. *Valizadeh, et al. (2013)* assessed the congruence of 70 neonatal nurses' activity in four areas of developmental care in NICUs in Tabriz, Iran. Their findings concluded that the congruence of nurses' performance with standards of developmental care still requires more efforts. The results of the present study were in accordance to the above mentioned empirical evidences and demonstrated that there were highly statistically significance differences between all steps of nurses' performance regarding implementation of DSC based tub bath for newborn infants. The improvement of nurses' performance became apparent after repeated baby bath for the second and third time after implementation the principles and strategies of DC. DSC should be

the basis for neonatal care because the DSC training program is able to usefully support nurses in providing better quality care to newborn infants in neonatal units.

Hunt (2011) commented that DSC fosters neurobehavioral and physiological organization with individualized care for each infant based on providing ongoing assessment. The goal of this kind of care is to help the newborn infant stabilize at each stage of maturation and to support emerging behaviors and organization while reducing the newborn infant's overall stress. On the same line, *Liaw et al. (2009)* concluded that the DSC training program reported successfully relieved newborn infants' stress-related behaviors during nursing procedures.

Recently, the *American Associations of Colleges of Nurses (2013)* reported that the newborn infants who received DC had more neurodevelopment until two years of age compared to the others. It was also estimated that they would suffer less from risk of long-term disability and behavioral problems until the age of five. The current study results were in accordance with above evidences and documented that the means of NBAS items were all significantly improved after application of DSC program. In particular, those items concerned with the habituation, motor system activities, state of organization reflexes (improved sucking reflex). The improvement in the newborns' behaviors became evidenced after repeated baby bath for the second and third time. It could be suggested that the benefits of DSC should not be limited to bathing activity; they should be applied to all medical and nursing procedures in neonatal units, such as feeding, changing diapers, suctioning, taking vital signs, inserting intravenous lines, inserting endotracheal tubes, drawing blood samples, and others.

Costas, Moragas, Mussons, Deu, and Zurita (2007) analyzed the gender differences in neonatal behavior for 188 full-term newborns (88 boys and 100 girls) using NBAS. The behavioral evaluations were performed using the NBAS when the infants were between 48 and 80 hours old. They found that girls had higher scores than boys in behavioral items of the NBAS. The current study results goes in the same direction and it was found the there were statically significant correlation between newborn infants' NBAS items particularly those concerned with habituation, social-interactive and reflexes items and their gender, girls showing higher levels of functioning than boys.

9-Conclusion

The current study concluded that the nurses who received the DSC program had higher knowledge score and improved level of performance during newborn infants' tub baths. Simultaneously, newborn infants exhibited less stress and greater comfort after the incorporation of DC principles and strategies during their tub bath and this was reflected in positive infant behavioral scores according to NBAS. These results support the proposed study hypotheses.

10-Recommendations

Based on the current study results, it was recommended that:

- Collaboration and continuing education of the staff in the NICU (doctors, nurses, etc.) are vital to improve the quality of care provided for newborn infants.
- Encourage families to participate, in partnership with NICUs staff; in designing a developmental care plan that meets their newborn infant's needs.
- Incorporate DSC policies and NICUs design and standards into national guidelines.
- Developmental care activities must continue to be tested through researches to determine which interventions work, what does not work, and which interventions need further refinement.
- Support research and quality assurance efforts to identify individual, institutional, and community barriers which limit infant access to developmentally supportive NICU care are essential.
- Future research is strategically targeted to fill the gaps and to provide more concrete information in the current evidence related to developmental care.

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12-References

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