

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

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Abstract

Background: Nurses must possess the necessary knowledge, competent practices, and positive attitude about preterm neonates' developmental supportive care, to effectively implementing this care model. **Aim:** Evaluate the effect of developmental supportive care program for preterm neonates on nurses' performance. **Design:** One group pretest-posttest quasi-experimental research design was adopted. **Sample:** A convenient sample of forty nurses who were providing care for preterm neonates. **Tools:** A structured interview questionnaire, observational checklists and Likert scale of nurses' attitude. **Results:** Most of nurses had unsatisfactory total score of knowledge in pretest, improved to most and less than two thirds of nurses had satisfactory (excellent total score) of knowledge in posttest and follow-up respectively, four fifths of nurses had incompetent total score of practice in pretest, improved to more than three quarters and less than two thirds of nurses to be competent in posttest and follow-up respectively. Highly statistically significant improvements were detected regarding the total mean scores of nurses' attitude between pre, post and follow-up. **Conclusion:** The developmental supportive care program had a positive effect on improvement of the total mean score of nurses' knowledge, practice and attitude with highly statistically significant differences. **Recommendation:** Ensure regular on job training programs for nurses about developmental supportive care to update their performance.

Keywords: Developmental supportive care, neonates, nurses, performance, preterm, program.

1. Introduction:

Developmental supportive care (DSC) refers to a broad category of interventions that is designed to minimize the stressors in the neonatal intensive care unit (NICU) environment and improve preterm neonates' adaptation to life outside the womb. These interventions include creating a healing environment by managing external stimuli by noise and light reduction, positive supportive touch methods like massage, containment holding, and kangaroo care, as well as clustering of nursing care, providing nonnutritive sucking, parental involvement in the care process and adopting developmentally supportive positioning using posture supports as nests and towels (**Hendy, Alsharkawy, & El-Nagger, 2023**).

Neonatal nurses are the primary caregivers in the NICU; they are in a key position to promote normal and healthy growth of preterm neonates through applying appropriate DSC practices (**Elsheshtawy, Arafa, & Khamis, 2022**).

The results of a study titled "Effect of developmental supportive care training program on nurses' practice regarding behavioral response of premature neonates"

conducted at the NICU of Tanta Main University Hospital, Egypt, illustrated that regarding the level of total nurses' knowledge about DSC, it was observed that majority of nurses (94%) had poor knowledge before the training program, while all and more than two thirds of nurses (100% and 68% respectively) had good knowledge immediately and one month after the DSC training program with highly statistically significant differences (**Henawy, Bahgat, Rahman, & Farag, 2021**).

Moreover, a systematic review about "Factors affecting the implementation of developmental care in the care of premature babies in NICU nurses: a systematic review" concluded that nurses' knowledge, attitudes, and perceptions of self-competence positively correlate with implementing DSC in the NICU and that training on developmental care and observation in its implementation is required to increase the competence of individual nurses (**Suryandari, Arief, & Utami, 2021**).

Regarding nurses' attitude toward DSC, the study entitled "Developmentally supportive care among neonatal intensive care unit nurses in South Korea knowledge, perceived importance, perception, and

perceived competence" revealed that the attitudes of Korean NICU nurses toward DSC for preterm infants were not positive and recommended applying interventions to improve NICU nurses' attitude toward supporting the development of preterm neonates as the more positive the neonatal nurses' attitude toward DSC, the better they perform DSC at NICU, and this should be considered an important issue in developing the competence of NICU nurses (**Lee, Park, & Cho, 2023**).

Significance of the study:

Many studies highlighted that insufficient knowledge, practices and negative attitudes of nurses are considered one of the major obstacles to implementing DSC in NICU, however, most studies of DSC have focused on infant outcomes, while it neglected studying nursing performance. It is surprising to note that a few studies have been done on nurses' performance and insufficient DSC programs had been implemented for improving their performance (**Klutse, Hillan, Wright, & Johnston, 2022**).

Neonatal nurses must have the competence to apply these DSC practices in NICU based on correct knowledge and

competent skills as well as positive attitudes. It is very crucial to design and offer attractive and effective educational programs which can not only standardize DSC approaches to neonatal care among all staff, but also improve preterm neonates and family outcomes, with the hope of reducing subsequent impairment and disability of preterm neonates (**Hendy et al., 2023**).

Developmental supportive care has been found to effectively improve medical outcomes of preterm neonates, such as reducing the need for respiratory support, promoting weight gain, facilitating earlier accomplishment of nipple feedings, shortening hospital stays, and lowering the overall cost of care. Additionally, it has been observed to support the attachment between parents and their neonates thus decreasing parental stress and anxiety. Although a growing body of evidence of short and long-term advantages of DSC, implementation has varied among institutions and widespread adoption has not been achieved yet (**Héon et al., 2022**).

Hopefully that the current study would add an evidence-based practice research aims to enhance the body of knowledge about DSC in pediatric nursing and improve the quality of nurses'

performance for maximizing outcomes for preterm neonates and their families.

Aim of the Study:

The aim of the present study was to evaluate the effect of developmental supportive care program for preterm neonates on nurses' performance.

Hypotheses:

- Nurses who receive preterm neonates' DSC program will have satisfactory scores of knowledge after program implementation than before.
- Nurses who receive preterm neonates' DSC program will be competent in DSC related practices after program implementation than before .
- Nurses who receive preterm neonates' DSC program will exhibit a positive attitude after program implementation than before.

2. Subjects and method:

Research design:

A quasi-experimental research design (one-group pretest-posttest design) was utilized in the current study.

Setting:

The current study was carried out at the NICU of Suez Canal University Hospitals.

Sample: A convenient sample of 40 nurses regardless of their age, level of education or their years of experience in NICU, who were providing care for preterm neonates in the above mentioned setting over 6 months period of data collection were comprised the sample of the current study.

Tools of the study: Three tools were utilized for data collection as the following:

Tool I: A structured Interview Questionnaire:

It was designed by the researcher after extensive review of related literature and then translated into simple Arabic language to assess nurses' personal characteristics and knowledge about developmental supportive care pre, post and follow-up the implementation of the program. It comprised of the following two parts:

Part (I): Personal characteristics of the nurses including age, gender, level of education, years of experiences in NICU, previous attendance of workshops or training programs about DSC for preterm neonates.

Part (II): Questions to assess nurses'

knowledge about DSC for preterm neonates (Hansen, Stark, Eichenwald, & Martin, 2022; Kassab & Hamadneh, 2021).

Scoring system:

The total number of questions that assessed the nurses' knowledge in the structured interview questionnaire was 52 questions, scored as follow; each complete correct answer was given two scores, incomplete correct answer was given one score, while incorrect answer or don't know was given zero score, the scores were summed up and then converted into percent. The total percent of nurses' knowledge was categorized as follows:

- Unsatisfactory (less than 60%)
- Satisfactory levels classified as follow:
 - Good = 60% to less than 75%
 - Very good = 75% to less than 85%
 - Excellent = 85% or more

Tool II: Observational Checklists of nurses' DSC practices:

The nurses' practices of DSC in the NICU were assessed pre, post and follow-up the implementation of the program using the observational checklists.

The observational checklists comprised of 64 steps to assess the nurses' practices regarding -:

- Healing environment (reducing noise, light and vision at NICU), it included (18) steps, clustering of care which included (2) steps and parental involvement which included (3) steps. It was adapted from **Carroll, Roan, Savin, Sengupta, and Piersol (2022)**.
- Positive supportive touch methods (kangaroo care, containment holding) which included (13) steps. It was adapted from **Carey, (2021)**.
- Non-nutritive sucking which included (8) steps, posture support and proper DSP (nesting, supported supine position, supported prone position, supported side-lying position) which included (20) steps. It was adapted from **Kenner and McGrath, (2021)**.

In all adapted checklists, some questions were added and some modified, items were putted in a form of a checklist by the researcher.

Scoring system:

The total number of steps in the observational checklist is 64 steps. Each step that was done completely and correctly was given one score and zero score for each step that wasn't done or was incorrectly done .

The total practice' scores were 64 score;

the scores were summed up and then converted into percent scores. Nurses' practices were considered to be competent if the nurse total score of practices percent was 70% or more and incompetent if the practices percent was less than 70%.

Tool III: Likert Scale of nurses' attitude:

Nurses' attitude regarding DSC for preterm neonates at NICU were assessed using nineteen 5-point Likert scale statements that was adopted from **Wu, (2009)**, the researcher translated the tool to Arabic language then back translation occurred to ensure the symmetry with the English form. The scale categorized into the following components, each component includes number of statements as follows:

- Individualized care (Statement 1, 2, 3).
- Healing environment (Statement 4, 5, 6, 7, 8, 9).
- Promoting comfort by non-nutritive sucking and swaddling (Statement 10, 11).
- Developmentally supportive positioning (Statement 12, 13, 14, 15, 16).
- Parental involvement (Statement 17, 18, 19).

Scoring system:

Likert response scale include strongly disagree (1), somewhat disagree (2), neutral

(3), somewhat agree (4), strongly agree (5). Total response score equal = 95, higher mean scores indicated that the nurse had a more positive attitude toward preterm neonates' DSC, while lower mean scores indicated that the nurse had negative attitude.

Procedures

The study was executed according to the following steps:

Ethical consideration: Primary approval was obtained from the Research Ethical Committee in the Faculty of Nursing, Suez Canal University. The researcher explained the aim and the nature of the study to the nurses for gaining their cooperation; written consent was obtained from each nurse to participate in the study after informing them about their voluntary participation and about their right to withdraw at any time from the study. The topic of this study didn't touch religious, ethical, moral and cultural issues among participants, nurses were assured that all gathered information will be confidential and will be used only for the purpose of the study.

Tools Validity and Reliability:

The study tools (tool I and tool II) were subjected to a jury of 3 experts in pediatric nursing and medicine to test the

content validity of items, determine whether the included items are comprehensive, understandable, applicable, clear and suitable to achieve the aim of the study and according to their opinions minor modifications were done. Tool III was adopted (standardized tool); content validity index rater form was 1.0.

Internal consistency of tool I (part II) and tool II was tested using Cronbach's alpha coefficient test and its value was (0.893) for knowledge items, (0.902) for nurses' DSC practices items of the observational checklists. Internal consistency of the tool III was tested by the author using Cronbach's alpha coefficient test, and the results showed a 90% consistency. The internal consistency of the Arabic form of tool III was tested using Cronbach's alpha coefficient test and its value was (0.899).

Pilot study

A pilot study was carried out after formulating the study tools and before starting data collection. It was conducted on 10% of the study sample that equal (4) nurses. It was carried out to evaluate the clarity and applicability of the study tools and to estimate the time needed to fulfill the tools and for program application.

Based on the results of the pilot study, the necessary modifications were done namely, ambiguous items were omitted, other items were modified according to the nurses' response and the final form was developed. The sample of the pilot study was included in the study sample.

Field Work

Data collection was carried out through three phases: interviewing and assessment phase, implementation phase and evaluation phase. The actual field work was carried out over a period of 6 months .

The total program sessions were nine; one session for pretest, the next six sessions used for implementing the DSC program , then one session for immediate posttest, and the last session was for follow-up that carried out after 2 months of program implementation.

A-Interviewing and assessment phase:

The researcher interviewed the nurses who were providing care for preterm neonates on an individual basis in the nursing room at the NICU of the study setting. The researcher introduced herself to the nurse, explained the aim of the study and its expected outcomes and written consent was taken from each nurse .

The first session devoted to the pretest phase. In the first session, the structured interview questionnaire of nurses' knowledge and the Likert scale of nurses' attitude were filled by the researcher through interview with each nurse individually, the average time needed to fill these two tools was about 1 hour period. Also, the observational checklists were filled by the researcher by observing the nurse' practices of DSC during providing care for preterm neonates over a course of an entire work' shift at the neonatal intensive care unit.

If the researcher was unable to observe all of the nurse's DSC practices during one shift (eg, kangaroo care because mothers of preterm neonates were not available on all shifts), the researcher was completing the nurse' observation the next day so that all the DSC' practices of each nurse were completely assessed.

The researcher was available two to three days per week for data collection. The researcher conducted the pre-test for all the study sample, then, she took the numbers of their telephone and the nursing monthly schedule (roster) in order to divide them to groups and arranged with them the best time for program application and after that for the follow-up phase.

B- Implementation phase

The total number of nurses was divided into 8 groups according to their work schedule. Sessions related to knowledge were carried out in the nursing room inside the NICU in the hospital at the afternoon and night shift only because it was so hard to implement the program in the morning shift because it was very crowded with the medical rounds and the rounds of infection control committee and the incubator was overcrowded with students either medical or nursing students which made it difficult of the nurses to concentrate and difficult of the researcher in teaching and applying the DSC practices inside the NICU.

The researcher instructed each group of nurses about the benefits of this program in improving their knowledge, practices and attitude regarding the preterm neonates' DSC. Various teaching strategies were used during the program application as lectures, brain storming, group discussion, simulation, demonstration and re-demonstration. Various teaching media was used as videos, pictures, doll, power point presentation as well as a booklet that was used as a teaching media. At the beginning of the DSC' sessions the researcher

distributed the DSC program booklet for each nurse.

The first session was devoted to the pretest phase. The second session was theoretical session included introduction about DSC program and an overview about prematurity. The third session was theoretical included an overview about DSC for preterm neonate at NICU which included definition, benefits and components of DSC. The fourth session was also theoretical included illustration the meaning of healing environment by controlling external stimuli (visual, auditory and visibility stimuli) and methods of applying it at NICU .

While, the fifth session was theoretical-practical session included teaching the nurses the positive supportive touch methods (Containment, massage, and kangaroo care) definition, benefits and techniques of applying them at NICU. The sixth session was theoretical- practical included teaching nurses definition, benefits, application of clustering of care, parental involvement and non-nutritive sucking at NICU.

Finally, the seventh session was also theoretical- practical included teaching nurses definition, purposes of nesting and demonstrating techniques of postural

support by using nests or towels and proper developmentally supportive positioning (supine, prone and side lying position).

The researcher demonstrated the preterm neonates' DSC related interventions using a doll at first after each practical session and then on a preterm neonate inside the incubator at the NICU. After that, the researcher observed every nurse individually during re-demonstration of interventions regarding DSC after each theoretical practical session, the researcher answered any questions, summarized each session for nurses and asked them for feedback and to illustrate any queries.

C- Evaluation phase .

Session eight and nine were concerned with evaluating nurses' performance immediately post DSC program implementation and after two months for follow-up. Session eight was devoted to immediate posttest phase, all nurses were assessed for their knowledge, practices and attitude, the structured interview questionnaire of nurses' knowledge and the Likert scale of nurses' attitude were filled by the researcher through interview with each nurse individually immediately after implementing the DSC

program, the average time needed to fill these two tools was about 1 hour period.

Also, the observational checklists were filled by the researcher by observing the nurse' practices of DSC during providing care for preterm neonates over a course of an entire work' shift at the NICU the same as what was done in the pretest.

Session nine was devoted for follow-up phase. After 2 months of DSC program implementation, all nurses were also assessed again for their knowledge, practices and attitude for follow-up the same as what was done in the pretest and posttest.

Statistical analysis

At the end of the fieldwork, data were organized, revised, tabulated and analyzed using statistical package of social science program, (SPSS package version 20). Continuous data were normally distributed and were expressed in mean \pm standard deviation (SD). Categorical data were expressed in number and percentage. One-way analysis of variance (ANOVA) test was used for comparison among more than two for variables with continuous data. Chi-square test was used for comparison of variables with categorical data. Correlation

co-efficient test was used to test for correlations between two variables with continuous data. Statistically significant difference detected when $p < 0.05$.

3. Results:

Table (1) reveals that, less than half (45%) of nurses were less than 25 years old with $\bar{x} \pm SD = 27.4 \pm 5.1$, the vast majority of nurses (95%) were females. Less than two thirds of nurses (65%) were graduated from technical nursing institute, while the minority of them (10%) had nursing bachelor degree. More than two thirds of nurses (70%) had less than 10 years of experience in NICU, while the minority of them (10%) had more than 20 years of experience with $\bar{x} \pm SD = 8.10 \pm 6.64$. Four fifths of nurses (80%) did not attend previous programs or workshops about DSC.

Table (2) clarifies that, most of nurses (85%) had unsatisfactory total score of knowledge in pretest, improved to most and less than two thirds of nurses (82.5% and 65% respectively) had satisfactory (excellent total score) of knowledge in posttest and follow-up respectively. The total mean score of nurses' knowledge in pretest was $\bar{x} \pm SD = 31.5 \pm 9.8$, improved in posttest and follow-

up to $\bar{x} \pm SD = 96.4 \pm 7.5$ and 90.2 ± 15.7 respectively. The differences were highly statistically significant.

Table (3) reveals that, four fifths of nurses (80.0%) had incompetent total score of DSC' practice in pretest, improved to more than three quarters and less than two thirds of nurses (77.5 % and 65% respectively) to be competent in posttest and follow-up. The total mean score of nurses' practice in pretest was $\bar{x} \pm SD = 16.7 \pm 5.5$, improved in posttest and follow-up to $\bar{x} \pm SD = 46.2 \pm 5.6$ and 36.1 ± 9.2 respectively. The differences were highly statistically significant.

Table (4) reveals that, highly statistically significant improvements were detected regarding the total mean scores of nurses' attitude domains; also the improvement is observed in total attitude mean score between pre, post and follow-up.

Table (5): illustrates that, the attitude of nurses was weakly correlated with nurses' knowledge and practice in pretest, improved in posttest and follow-up to be moderately correlated with highly statistically significant differences.

4. Discussion:

Developmental supportive care is still a relatively new approach to care and

widespread adoption has not been achieved yet despite a growing body of evidence highlighted the positive impact of DSC on preterm neonates. To successfully implement DSC in NICU, it is essential that the neonatal nurses possess sufficient knowledge, skills, and a positive attitude towards this approach. As a result, it is crucial to implement effective educational programs to ensure implementation of standardized DSC practices (**Lee & Cho, 2023**).

Regarding nurses' total score of knowledge and total mean score, the present study results revealed that most of nurses had unsatisfactory total score of knowledge in pretest, improved to most and less than two thirds of nurses had satisfactory (excellent total score) of knowledge in posttest and follow-up respectively. The total mean score of nurses' knowledge/ 104, in pretest was $\bar{x} \pm SD = 31.5 \pm 9.8$, improved in posttest and follow-up to $\bar{x} \pm SD = 96.4 \pm 7.5$ and 90.2 ± 15.7 respectively. The differences were highly statistically significant.

These results were consistent with **Youssef, (2020)** in a study about "Effectiveness of nurses' training program about neuroprotective developmental care

for premature neonates on their knowledge and practices in neonatal intensive care unit" who revealed that more than three quarters of nurses had poor knowledge before the training program, while most and three quarters of nurses had good knowledge score immediately and one month after the training respectively and the differences were statistically significant.

Lee and Cho, (2023) in a study titled "Effectiveness of NICU nurses' competence enhancement program for developmentally supportive care for preterm infants: A quasi-experimental study" also supported the study results and reported that nurses' total knowledge scores about DSC improved after applying the manual program.

From the researcher point of view, the improvement in nurses' total score of knowledge in posttest may be attributed to their enthusiasm and desire to enrich their knowledge and their awareness of the importance of implementing any new model of care for preterm neonates in NICU context. While, the slight decline in nurses total score of knowledge in follow-up refers to the importance of ongoing and periodical training of staff nurses regarding DSC.

The previous study results prove the

first hypothesis of the study titled "Nurses who receive preterm neonates' DSC program will have satisfactory scores of knowledge after program implementation than before".

Regarding differences in nurses' total DSC' practice level between pre, post and follow-up, the current study results revealed that four fifths of nurses had incompetent total score of practice in pretest, improved to more than three quarters and less than two thirds of nurses respectively to be competent in posttest and follow-up with highly statistically significant differences.

These results agreed with **Henawy et al. (2021)** who revealed that there was a significant improvement in total score of nurses' practice after the implementation of the DSC training program. Also, agreed with **Mohammed, Khamis, and Sabry, (2018)** in a study titled "Effect of preterm neonates' developmental supportive care program on nurses' performance" who revealed that none of the nurses obtained good total score of performance related to DSC before program, improved to three quarters (74%) of nurses had good total score of performance immediately after the program, this percent decreased to 42% three months later with statistically significant differences.

Moreover, these results were in accordance with the study conducted by **Elziady, Ouda and Hassan, (2017)** titled "Effect of implementing an educational program about family centered developmental care on neonatal nurses' knowledge and practices at neonatal intensive care units" who illustrated that statistically significant improvements were detected regarding total score of nurses' DSC practices immediately after as well as at follow-up phase after the program implementation compared with pretest as all (100%) of nurses had an unsatisfactory total score of practice in pretest, which improved to 80.4% and 55.3% of nurses respectively had competent total score of practice immediately post and at follow-up.

Improvement in nurses' total level of practice after program application may be interpreted by the researcher as increased nurses' perceived benefits of applying DSC and their commitments toward improving their practices when they have the chance to attend training to provide a high quality of care for preterm neonates in NICU.

The current study results revealed that the total mean score of nurses' practice/ 64, the mean score in pretest was $\bar{x} \pm SD = 16.7 \pm 5.5$, improved in posttest and follow-up to

$\bar{x} \pm SD = 46.2 \pm 5.6$ and 36.1 ± 9.2 respectively, the differences were highly statistically significant. These results agreed with **Henawy et al. (2021)** who concluded that the mean scores of nurses' practice improved immediately and one month after than before the DSC program.

The current results regarding nurses' practices prove the second study hypothesis entitled "Nurses who receive preterm neonates' DSC program will be competent in DSC related practices after program implementation than before".

Concerning nurses' attitudes regarding developmental supportive care for preterm neonates, the current study results revealed that highly statistically significant improvements were detected regarding the total mean scores of nurses' attitude domains including individualized care, healing environment, promoting comfort by nonnutritive sucking and swaddling, developmentally supportive positioning and parental involvement; also the improvement is observed in total attitude mean score between pre, post and follow-up.

These results were in agreement with the study conducted by **Syamsu, Batjo and Kolomboy, (2022)** titled "The seven points of developmental care for preterm

neonates: nurses' knowledge and attitudes in the NICU room" who showed that a significant increase in NICU nurses' attitudes in the provision of the seven points of developmental care including healing environment, principles of cooperation with families, minimizing pain by touching, family centered care principles, nonnutritive sucking, and infant positioning after being given education which reveals that the provision of education helping the nurses to improve their attitudes toward consistency of providing developmental care.

These results were supported also by **Mohamed and Abdelhamed, (2022)** in a study titled "Enhancement of nurses performance toward developmental supportive care as nesting and swaddling technique for premature infant" who reported that less than three quarters of nurses had a positive attitude post-program implementation, compared to a minority of them pre-program. There were statistically significant differences between nurses' attitude results regarding all items pre-and post-implementing the program.

In this context, a study about "Factors influencing developmental care practice among neonatal intensive care unit nurses"

carried out by **Park and Kim, (2019)** who revealed that after receiving individualized developmental care and assessment program training, most of the nurses had positive attitudes about implementation of DSC in NICU.

The current study results prove the third hypothesis entitled "Nurses who receive preterm neonates' DSC program will exhibit a positive attitude after program implementation than before".

In relation to the correlation between nurses' knowledge, practice and attitude, the current study results revealed that the attitude of nurses was weakly correlated with nurses' knowledge and practice in pretest, improved in posttest and follow-up to be moderately correlated with highly statistically significant differences.

These results were inconsistent with **Kunswa and Bayoumi, (2018)** in a study titled "Evidence based nursing practices of developmental supportive care for preterm neonates: intervention program for internship nursing students" who clarified that, there was negative correlation ($r = 0.035$ and 0.175) between total score of internship nursing students' knowledge, practices and their attitude regarding DSC in NICU post intervention program.

5. Conclusion:

Based on the study' findings, it can be concluded that the DSC program had a positive effect on improvement of the total mean score of nurses' knowledge, practice and attitude with highly statistically significant differences.

6. Recommendations:

In the light of the current study findings the following recommendations are suggested:

- Ensure regular on job training programs for nurses about DSC to update their knowledge.
- Utilize the DSC practices in routine nursing care for preterm neonates in NICU to develop positive attitude toward DSC.

Conflict of interest:

Authors declare no conflict of interest.

Acknowledgement:

The researchers appreciate the collaboration of the nurses who agreed to participate in the study.

Table (1): Percentage distribution of nurses according to their personal characteristics (n=40)

Items	N	%
Age (Years)		
< 25	18	45.0
25 – 30	12	30.0
>30	10	25.0
$\bar{x}\pm SD$	27.4 ±5.1	
Gender		
Male	2	5.0
Female	38	95.0
Level of Education		
Secondary nursing school	10	25.0
Technical nursing institute	26	65.0
Bachelor degree of nursing science	4	10.0
Years of experiences in NICU		
<10	28	70.0
10 – 20	8	20.0
> 20	4	10.0
$\bar{x}\pm SD$	8.10 ±6.64	
Attendance of previous programs or workshops about DSC		
Yes	8	20.0
No	32	80.0

Table (2): Differences in nurses' categories of total score of knowledge and total mean score between pre, post and follow-up the application of the DSC program (n=40)

Items	Pre –test		Post –test		Follow – Up		X ²	p-value
	N	%	N	%	N	%		
Unsatisfactory (< 60%)	34	85.0	0	0.0	2	5.0	102.490	<0.001**
Satisfactory (60% and more)								
-Good (60% to < 75%)	6	15.0	2	5.0	3	7.5		
-Very good (75% to < 85%)	0	0.0	5	12.5	9	22.5		
- Excellent (= or > 85%)	0	0.0	33	82.5	26	65.0		
Total knowledge score/ 104	Pre –test		Post –test		Follow – Up		One-way ANOVA	
							F	p-value
$\bar{x}\pm SD$	31.5 ±9.8		96.4 ±7.5		90.2 ±15.7		385.921	<0.001**

Table (3): Differences in nurses' total DSC' practice level and total mean score of practice between pre, post and follow-up the application of the DSC program (n=40)

Items	Pre-test				Post-test				Follow – Up				X ²	p-value
	Incompetent		Competent		Incompetent		Competent		Incompetent		Competent			
	<70%		>70%		<70%		>70%		<70%		>70%			
	N	%	N	%	N	%	N	%	N	%	N	%		
Total practice level	32	80.0	8	20.0	9	22.5	31	77.5	14	35.0	26	65.0	29.471	<0.001**
Total practice score/ 64	Pre-test				Post-test				Follow-up				One-Way ANOVA	
													F	p-value
$\bar{x}\pm SD$	16.7 ±5.5				46.2 ±5.6				36.1 ±9.2				182.538	<0.001**

Table (4): Differences in mean scores of nurses’ attitude domains and total mean score between pre, post and follow-up the application of the DSC program (n=40).

Attitude’ Domains	Pre-test	Post-test	Follow – Up	One-way ANOVA	
	$\bar{x}\pm SD$	$\bar{x}\pm SD$	$\bar{x}\pm SD$	F	p-value
Individualized care/15	6.0 \pm 2.1	12.7 \pm 2.2	11.9 \pm 1.7	131.344	<0.001**
Healing environment/30	15.4 \pm 3.5	27.2 \pm 4.1	24.5 \pm 3.5	109.880	<0.001**
Promoting comfort by non-nutritive sucking and swaddling/10	4.5 \pm 1.6	8.7 \pm 1.8	8.4 \pm 1.5	77.199	<0.001**
Developmentally supportive positioning/25	10.4 \pm 3.3	21.9 \pm 3.9	20.0 \pm 3.7	113.811	<0.001**
Parental involvement/15	7.1 \pm 2.0	13.1 \pm 2.4	10.9 \pm 2.8	61.280	<0.001**
Total Nurses’ Attitude mean score/ 95 $\bar{x}\pm SD$	43.4 \pm5.5	83.5 \pm11.9	75.6 \pm9.6	205.301	<0.001**

Table (5): Correlation between nurses’ knowledge, practice and attitude pre, post and follow-up after the application of the DSC program (n=40).

	Nurses’ Attitude					
	Pre-test		Post-test		Follow – Up	
	R	P	r	p	r	P
Nurses’ Knowledge	0.114	0.483	0.621	<0.001**	0.518	<0.001**
Nurses’ Practice	0.127	0.435	0.737	<0.001**	0.512	<0.001**

7. References:

Carey, S. (2021): Clinical Guideline: Developmental Care. Neonatal Clinical Oversight Group, National Health Service, 4-44.

Carroll, A., Roan, C., Savin, M., Sengupta, A., & Piersol, C. (2022). Neonatal Intensive Care Unit Caregiver Behavior Checklists (NICU-CBC). Department of Occupational Therapy Faculty Papers: Thomas Jefferson University, 87(7), 1-15.

Elsheshtawy, O., Arafa, N., & Khamis, G. (2022). Effect of Wee Care on Physical Growth and Behavioral Responses of Preterm Neonates. Port Said Scientific Journal of Nursing, Egypt, 9(2), 154-180.

El-Ziady, S., Ouda, W., & Hassan, R. (2017). Effect of Implementing an Educational Program about Family Centered Developmental Care on Neonatal Nurses' Knowledge and Practices at Neonatal Intensive Care Units. Mansoura Nursing Journal, Egypt, 4(2), 171-190.

Hansen, A., Stark, A., Eichenwald, E., & Martin, C. (2022). CLoherly and Stark's Manual of Neonatal Care. 9th edition:

Lippincott Williams & Wilkins, 17-70.

Henawy, S., Bahgat, R., Rahman, A., & Farag, N. (2021). Effect of Developmental Supportive Care Training Program on Nurses' Practice regarding Behavioral Response of Premature Neonates. International Journal of Advanced Research, 4(1), 216-225.

Hendy, A., Alsharkawy, S., & El-Nagger, N. (2023). Nurses' Performance about Creating Healing Environment and Clustering Nursing Care for Premature Infants. Egyptian Journal of Health Care, 14(2), 148-158.

Héon, M., Aita, M., Lavallée, A., Clifford-Faugère, G., Laporte, G., Boisvert, A., & Feeley, N. (2022). Comprehensive Mapping of NICU Developmental Care Nursing Interventions and Related Sensitive Outcome Indicators: A scoping Review Protocol. BMJ open, 12(1), 1-8.

Kassab, M., & Hamadneh, S. (2021). Developmental Care Practices at Neonatal Intensive Care Units in Developing Countries, Handbook of Healthcare in the Arab World: Springer International Publishing, 2573-2588.

Kenner, C., & McGrath, J. (2021). Developmental Care of Newborns & Infant.

3rd edition: Lippincott Williams & Wilkins, 220-256.

Klutse, K., Hillan, E., Wright, A., & Johnston, L. (2022). Facilitators and Barriers to Developmentally Supportive Care for Preterm Infants in Low and Middle-Income Countries: A scoping Review. *Journal of Neonatal Nursing*, 28(6), 388-402.

Kunswa, M., & Bayoumi, O. (2018). Evidence Based Nursing Practices of Developmental Supportive Care for Preterm Neonates: Intervention Program for Internship Nursing Students. *IOSR Journal of Nursing and Health Science*, 7(6), 50-68.

Syamsu, A., Batjo, S., & Kolomboy, F. (2022). The Seven Points of Developmental Care for Preterm Neonates: Nurses' Knowledge and Attitudes in the NICU Room. *World Journal of Advanced Research and Reviews*, 16(1), 677-684.

Suryandari, C., Arief, Y., & Utami, S. (2021). Factors Affecting the Implementation of Developmental Care in the Care of Premature Babies in NICU Nurses: A Systematic Review. *Pedimatern Nursing Journal*, 7(2), 77-83.

Lee, H., & Cho, H. (2023). Effectiveness of Nicu Nurses' Competence Enhancement

Program for Developmentally Supportive Care for Preterm Infants: A quasi-Experimental Study. *Heliyon*, 9(1), e12944.

Lee, H., Park, J., & Cho, H. (2023). Developmentally supportive care among neonatal intensive care unit nurses in South Korea: knowledge, perceived importance, perception, and perceived competence. *Advances in Neonatal Care*, 23(3), E60-E69.

Mohamed, F., & Abdelhamed, T. (2022). Enhancement of Nurses Performance toward Developmental Supportive Care as Nesting and Swaddling Technique for Premature Infant. *Egyptian Journal of Health Care*, 13(1), 1333-1344.

Mohammed, R., Khamis, G., & Sabry, Y. (2018). Effect of Preterm Neonates' Developmental Supportive Care Program on Nurses' Performance. *IOSR Journal of Nursing and Health Science*, 7(4), 33-45.

Park, J., & Kim, J. (2019). Factors Influencing Developmental Care Practice among Neonatal Intensive Care Unit Nurses. *Journal of Pediatric Nursing*, 47(1), e10-e15.

Wu, C. L. (2009). A pilot Survey of Nurses' Attitudes and Practice of Developmentally

Supportive Care in NICUs in Taiwan:
Published PHD thesis in University of
Washington, 43-150.

Youssef, M. (2020). Effectiveness of
Nurses' Training Program about
Neuroprotective Developmental Care for
Premature Neonates on their Knowledge and
Practices in Neonatal Intensive Care Unit.
International Journal of Novel Research in
Healthcare and Nursing, 7 (8), 1-16.