
Impact of an Educational Program on Pediatric Nurses' Practice Regarding Non-Pharmacological Pain Management in Neonatal Intensive Care Units

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ABSTRACT

Background: Newborns in the neonatal intensive care units (NICU) can be exposed to many painful procedures and treatments. **Aim:** This study was to improve nurses' practice regarding non-pharmacological management of pain in newborns in neonatal intensive care units. **Subjects and Method:** A quasi-experimental research design was utilized in this study. The subjects of the study consists of all the nurses working in the NICUs in Port Said hospitals (N=40) affiliated to the Ministry of Health, including El-Nasr general hospital, Port Said general hospital, Port Fouad general hospital and El-Tadamon health insurance hospital. The data were collected using a observational checklists **Conclusion:** the nurses had statistically significant improvements in applying non-pharmacological pain management during painful procedures in newborns included; venous and arterial puncture, cannulation and umbilical catheter insertion. However, there were inadequate total scores regarding nurses' practice. **Recommendation:** continuous training courses should be provided to nurses in order to keep their practice regarding non-pharmacological pain management up to date. Also, nurses should be encouraged to attend national and international conferences and workshops about non-pharmacological management for newborns

Keywords: non-pharmacological, pain management, neonates, NICU, nurses

INTRODUCTION

Pain is defined as “unpleasant sensation, usually associated with diseases or injuries or described in terms of such damage” (International Association of Pain, 2014). In other words; pain is an uncomfortable emotional experience caused by real or potential lesions (Anand et al., 2011).

Until recently, it was believed that newborns were insensitive to pain because of having an immature nervous system. Nowadays, research has proved that human beings are able to perceive pain since the fetal period (Hatfield, 2014). Newborns can detect, process and respond to painful stimuli (Cong et al., 2013). Even more, they can feel pain more than adults and older children due to incomplete myelination of neurons (Hatfield, 2014). Newborns have 30-50% lower pain threshold than adults and a lower pain tolerance than older children (Cong et al., 2013).

Pain management is an indicator for the quality of care (Lago et al., 2013). Pain management involves the techniques used to prevent, reduce or relieve pain in newborns. Pain relief strategies include pharmacological and non-pharmacological methods (Campbell-Yeo et al., 2011; Bueno et al., 2013).

Non-pharmacological approaches are often performed as the first step in neonatal pain management, because it minimizes neonatal pain and stress while maximizing the newborn’s own regulatory and coping abilities. Non-pharmacological strategies have no side-effects and can reduce acute pain from invasive or non-invasive procedures (Hall and Anand, 2014). Non-pharmacological methods provide improved growth outcomes, shorter durations of mechanical ventilation and oxygen supplementation, decreased length of stay and cost of hospitalization in addition to improved neurodevelopmental outcomes (Ohlsson and Jacobs, 2013).

Non-pharmacological interventions for newborns include: sweet oral solution, non-nutritive sucking (NNS), containment/facilitated tucking/swaddling, massage, skin-to-skin care or kangaroo care, breastfeeding/breast milk, multisensorial stimulation, limiting environmental stimuli, auditory recognition/music therapy (Pillai Riddell et al., 2011; Buonocore et al., 2012; MacDonald and Seshia, 2015), quiet lighting, talking to baby, slow stroking/rocking, positioning on side and comfort holding with still hands (Lissauer et al., 2016). Healthcare facilities should establish pain control programs for newborns. The first step is to minimize the total number of painful events whenever possible. If a procedure cannot be avoided, pain should be managed using environmental, non-pharmacological, and pharmacological modalities (Witt et al., 2016).

Significance of the study:

Pain is considered the fifth vital sign and is a major symptom related to many health problems. The prevention and alleviation of pain in neonates, particularly preterm infants, is important from an ethical point of view, and also because exposure to repeated painful stimuli early in life causes short- and long-term adverse sequelae including physiological instability, altered brain development, abnormal neuro-development, somatosensory and stress response systems, which can persist into childhood

AIM OF THE STUDY:

The aim of this study was to evaluate and improve nurses' practice regarding non-pharmacological management of pain among newborns in neonatal intensive care units.

SUBJECTS AND METHOD:**Research design**

A quasi-experimental research design was utilized in this study

Study setting:

The study was conducted at the neonatal intensive care units (NICU) at Port Said hospitals affiliated to the Ministry of Health, including El-Nasr general hospital, Port Said general hospital, Port Fouad general hospital and El-Tadamon health insurance hospital.

Study subjects:

The subjects of the current study included all the nurses working in the previously mentioned settings in NICU regardless their years of experience or qualifications. The number of subjects was 40 in pre- and post-intervention phases and 34 in follow-up phase.

Tools of data collection:

Tool I:

Structured interview questionnaire sheet: included questions concerning the characteristics of the studied nurses such as age, level of education, years of experience in neonatal nursing, marital status, number of children, and attending previous training programs concerning the non-pharmacological methods of pain management in newborns.

Tool II:

Observational checklists:

An observational checklists was used to evaluate the nurses' practice in applying non-pharmacological pain management to relieve pain in newborns in different painful procedures in NICU (like non-nutritive sucking (NNS), swaddling, soothing vocalization, auditory material, baby's perfume on the nurse's hands, positive touching , facilitate tucking, holding , rhythmic rocking, partial massage, breast milk by bottle, put the newborn in nesting inside incubator).

Content validity of the tools:

The study tools of the current study were ascertained by seven experts in the field of pediatric nursing. Necessary modifications were made according to their opinions.

Reliability of the tool:

It was assessed on 8 nurses in El-Nasr general hospital's NICU. Cronbach's alpha coefficient was used to assess the internal consistency of the tools, its value was (0.77).

Pilot Study:

A pilot study was carried out on 4 nurses working at El-Nasr general hospital's NICU. The purpose of the pilot study was to test the applicability, clarity, relevance, and feasibility of the study tools and the sequence of questions to maintain consistency. The pilot study also helped estimate the time needed to complete the tools. Afterwards, the necessary modifications were done such as rephrasing of the tool's questions and the final form of the tools was developed. The subjects in the pilot study were excluded from the final study sample

Method of Data Collection:

- Data collection took place in the selected settings from the beginning of January 2016 till the end of January 2017. The pre-test was done from 1st of January to the end of February 2016, while the post-test was done from 1st of July to the end of August 2016, and the follow up was done 3 months after the post-test (1st of December 2016 to the end of January 2017).
- The researcher was available during each of the study phases 3 days per week. From 2 to 3 nurses were observed per day.
- Observational checklists regarding applying the methods of non-pharmacological management of pain was assessed and using during the nurses' actual practice. These steps were achieved before and after the educational program and 3 months later, to assess nurses' practice regarding non-pharmacological management of pain in newborn.

The educational program :**Construction:**

The researcher developed the educational program using the baseline information gathered in the assessment phase. Hence, the program was designed based on the identified needs and demands of the nurses, and in the light of the most recent pertinent literature. It was written in simple Arabic language and contained:

Content:

It was selected according to the program's objectives and nurses' actual need assessment, and included: the definition of pain, pathophysiology of pain, causes of pain in newborns, intensity of painful procedures, complications of continuous pain, physiological and behavioral indicators of pain in newborns. It also covered instructions concerning the pain scales that evaluated the intensity of pain, in addition to nurses' roles when using pain scales .

The educational program also included knowledge about non-pharmacological management of pain in newborns regarding its definition, benefits and methods of non-pharmacological management included (non-nutritive sucking (NNS), swaddling, soothing vocalization, auditory material, baby's perfume on the nurse's hands, positive touching , facilitate tucking, holding , rhythmic rocking, partial massage, breast milk by bottle, put the newborn in nesting inside incubator) .

Teaching methods and aids:

Different strategies were implemented, such as traditional modified lectures, demonstration, re-demonstration and group discussions. Audiovisual materials were also used to further explain some topics.

• Implementation of program :

The application of the program was carried out at the NICU departments in the selected study settings. The program was implemented in 6 sessions; the duration of each one lasted from 40 to 50 minutes. The study sample was divided into multiple groups, with 2-3 nurses in each session. There were 3 sessions per week according to the number of nurses in each hospital. The educational program was completely implemented within 4 months (without post-test), from 1st of March to the end of June 2016.

- **Evaluation of the nurses:**

The nurses were evaluated 3 times; before the program application, immediately after the program's implementation, and 3 months later.

Statistical Design:

Scoring System:

The studied nurses' answers were compared with a model key, where (1) score was given if the nurse performed correctly the item, and (0) was given if the item was incorrectly or not performed

According to the nurses' responses, their level of practice was categorized as: adequate ($\geq 60\%$) and inadequate ($< 60\%$).

Statistical Analysis:

Descriptive statistics including frequency and distribution were used to describe different characteristics. Qualitative variables were compared by using Chi-Square test or Fisher's exact test before/immediately and after within one group. The significance of the results was evaluated at $\leq 0.05\%$ level of significance.

Administrative design:

Official letters were issued from the Dean of the Faculty of Nursing, Port Said University to the directors and heads of the NICU departments of the governmental and health insurance hospitals in Port Said to obtain their permission for conducting the study.

Ethical Considerations:

Written permission for collection of data was obtained from the directors of the study setting hospitals after explaining the aim of the study. Also, the aim was explained to each nurse participant to clarify the importance of her participation in the study. The researcher promoted the confidentiality of the collected data and assured the study sample that the information obtained during the study was to be used only for the purpose of the study, also the researcher clarified to the nurses that they were free to withdraw from the study at any time.

RESULTS:

Table (1): illustrated the characteristics of the studied nurses, and showed that more than half of the studied nurses (62.5%) aged between 20 to less than 25 years, 57.5 % of them graduated from technical nursing institutes, while 15.0% had baccalaureate nursing degrees. Regarding marital status, 57.5% of the nurses were married, and more than three quarter (76.0%) had children.

Moreover, it was revealed that more than half of the studied nurses (60.0%) had 1 to less than 3 years' experience in NICU, and one third of them (30.0%) attended courses about non-pharmacological pain management in newborns.

Table (2): this table showed nurses' practice in using oral sucrose and non-nutritive sucking as non-pharmacological management of pain in newborn during arterial puncture, cannulation and injections, it demonstrated that all of the studied nurses used NNS and oral sucrose during arterial puncture, cannulation and injections after the educational program

Table (3): presented total scores of nurses' practice in applying non-pharmacological pain management during painful procedures. It indicated that none of the studied nurses had adequate pre-intervention practice.

The post-intervention phase showed statistically significant improvements in applying non-pharmacological pain management during painful procedures in newborns like: cannulation (42.5%), venous puncture (35%), arterial puncture (30%) and umbilical catheter insertion (22.5%). Moreover, there were little improvements at the follow-up phase, like in cannulation (29.4%) and venous puncture (11.8%).

Table (4): revealed no statistically significant differences between nurses' total practice scores and their characteristics, except for statistically significant differences ($P \leq 0.5$) between nurses' total practice scores and duration of experience in NICU at post-intervention, as the practice scores were statistically higher among nurses with experience from 3-<6 years.

Figure (1): Displayed total scores of adequate nurses' practice. It clarified that none of the studied nurses had adequate practice pre-intervention or during follow-up. However, only 5% had adequate practice post-intervention.

Table (1): characteristics of the studied nurses.

Socio-demographic characteristics	No. (n= 40)	%
Age (years):		
20- < 25	25	62.5
25- ≤ 30	15	37.5
± SD	24.4±2.4	
Education level:		
Baccalaureate nursing degree.	6	15.0
Technical nursing institute.	23	57.5
Secondary nursing school.	11	27.5
Marital status:		
Single.	15	37.5
Married.	23	57.5
Divorced/widowed.	2	5.0
Have children (n=25):	6	
No.	19	24.0
Yes.		76.0
Experience in NICU / years:	3	7.5
< 1	24	60.0
1-< 3	4	10.0
3- < 6	9	22.5
6 or more		
Number of courses attended about non-pharmacological pain management in newborns:	28	70.0
No.	12	30.0
Yes (once).		

Table(2): Nurses' practice regarding oral sucrose and non-nutritive sucking as non-pharmacological management of pain in newborn during arterial puncture, cannulation and injections

	Post program					
	Arterial Puncture		Cannulation		Injections	
	No. (n=40)	%	No. (n=40)	%	No. (n=40)	%
Oral sucrose	40	100.0	40	100.0	40	100.0
Non-nutritive sucking	40	100.0	40	100.0	40	100.0

Table (3): Total scores of nurses' practice in applying non-pharmacological pain management during painful procedures

Total scores of practice	Program phases						χ^2 (P. value) Pre-/Post-	χ^2 (P. value) Pre-Follow-up
	Pre-		Post-		Follow-up			
	No. (n=40)	%	No. (n=40)	%	No. (n=34)	%		
Heel stick.	0	0.0	5	12.5	2	5.9	0.055	0.208
Venous puncture.	0	0.0	14	35.0	4	11.8	<0.0001*	0.040*
Arterial puncture.	0	0.0	12	30.0	2	5.9	<0.0001*	0.208
Cannulation.	0	0.0	17	42.5	10	29.4	<0.0001*	0.0002*
Injections.	0	0.0	0	0.0	0	0.0	-NA-	-NA-
Adhesive tape removal.	0	0.0	1	2.5	0	0.0	1.0	-NA-
Suctioning.	0	0.0	0	0.0	0	0.0	-NA-	-NA-
Naso- /oro-gastric tube insertion.	0	0.0	4	10.0	0	0.0	0.116	-NA-
Umbilical catheter insertion.	0	0.0	9	22.5	0	0.0	0.006*	-NA-
Chest tube insertion.	0	0.0	3	7.5	0	0.0	0.238	-NA-
Endotracheal tube insertion.	0	0.0	1	2.5	1	2.9	1.0	0.467

Table (4): Relation between total practice scores and characteristics of the studied nurses.

Characteristics	Total practice scores					
	Pre- (n=40)		Post- (n=40)		Follow-up (n=34)	
	Mean±SD	Significance	Mean±SD	Significance	Mean±SD	Significance
Age (years):						
20-<25	7.4±4.3	Z=1.118	45.8±6.4	t=0.601	36.4±5.9	t=0.950
25-≤30	8.8±4.1	P=0.263	44.5±7.2	P=0.551	34.3±7.4	P=0.349
Educational level:	5.6±6.4	^{KW} χ ² =1.554	41.8±9.9	F=1.778	33.0±5.2	F=0.428
Baccalaureate nursing degree.	8.2±3.9	P=0.460	46.9±5.9	P=0.183	36.1±6.4	P=0.655
Technical nursing institute.	8.7±3.3		43.9±5.4		35.8±7.6	
Secondary nursing school.						
Duration of experience in NICU (years):		^{KW} χ ² =6.775		F=3.449		F=0.742
< 1	7.5±2.8	P=0.079	45.7±2.6	P=0.027*	40.9±5.6	P=0.536
1-<3	6.8±4.2		44.9±4.1		35.1±5.1	
3-<6	11.8±1.9		52.8±8.6		35.5±8.2	
6 or more	9.4±4.3		41.9±9.1		34.5±9.5	
Number of courses attended about non-pharmacological pain management in newborns:						
No	7.4±4.4	Z=1.344	44.3±5.9	t=1.477	36.4±6.4	t=1.245
Yes (once)	9.3±3.7	P=0.182	47.6±7.9	P=0.148	33.3±6.8	P=0.222
t: Student's t-test, Z: Mann Whitney test, ^{KW}χ²: Kruskal Wallis test, F: ANOVA test, P≤0.05						

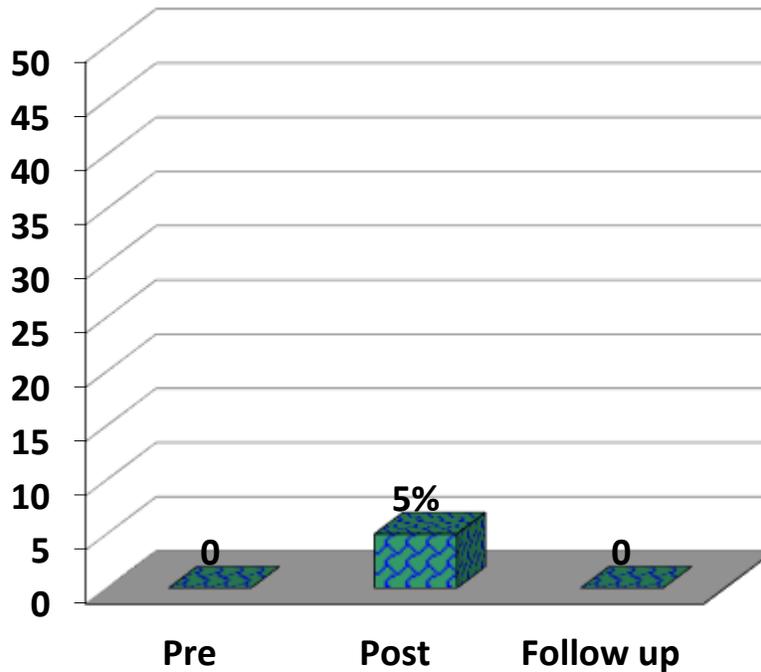


Figure (1): Total scores of adequate nurses' practice

DISCUSSION:

After the implementation of the present study, the practices of the studied nurses improved in few aspects and the nurses demonstrated total inadequate practices. The rationale for such findings may have been due to: the nurses not having sufficient time to assess and manage neonatal pain; workload and decreased number of staff nurses; no training and lack of protocols on neonatal pain assessment and management or, if found, not strictly following them; not knowing which pain relief interventions were effective in neonates and being busy with routine daily work.

Capellini et al. (2014) and Cong et al. (2014) mentioned many factors that blocked the implementation of pain management strategies; including resistance to change, lack of knowledge, lack of time, inadequate collaboration/relationships between nurses and physicians and lack of trust in the pain assessment tools. These results were consistent with Ozawa and YoKoo (2013) in Japan, who reported that about 60% of NICUs had no

guidelines for pain management. Chen et al. (2012) in China, stated that the healthcare professionals in NICUs did not provide pain relief interventions at all for procedural pain. Jeong et al. (2014) added that non-pharmacological management was rarely performed except in cases of chest tube/central catheter insertion. Also, Cong et al. (2013) showed that there was incongruity in knowledge, evidence and practice regarding pain assessment and management for neonates, despite an increase in evidence and published guidelines regarding this area of research. Foster et al. (2013); Ozawa and Yokoo (2013) found that although many nurses identified evidence-based pain care for specific painful procedures, only a small number actually translated this knowledge into practice. On the other hand, Gradin and Eriksson (2011); Lago et al. (2013) reported that neonatal pain assessment and management have improved over the years.

Regarding nurses' practice about non-pharmacological management of pain in newborns in different nursing care activities, all of the studied nurses used NNS and oral sucrose during arterial puncture, cannulation and injections after the educational program. This finding may have been attributed to the nurses' observation that after the application of these practices for newborns in pain, they became calm and more comfortable.

These findings were supported by Lake (2013), who mentioned that the studied nurses reported the use of sucrose pacifiers for PICC "Peripherally Inserted Central Catheter" insertion, IV insertion, IM injection, and heel lance. Moreover, in a study done by Abdel Razeq (2016), the participants supported the use of non-pharmacological pain relief measures, like oral sucrose and pacifiers. Also, Suciú et al. (2015) illustrated that 77% of the respondents reported the administration of sweet analgesia after painful interventions. Witt et al. (2016) in the United States, also mentioned that sucrose significantly reduced pain associated with procedures and caused significant reductions in behavioral and physiological indicators of pain, and recommended glucose for arterial puncture. Harrison et al. (2012) in Canada, illustrated that sucrose, glucose, or other sweet solutions reduced pain responses during commonly-performed painful procedures. There is sufficient evidence to support that oral sucrose combined with NNS had a better effect on pain relief than either of them alone (Bueno et al., 2013; Dilli et al., 2014; Ucar et al., 2014; Yan et al., 2016).

This study also revealed that at the post-intervention phase, the studied nurses showed adequate practices regarding non-pharmacological management for newborns during venous puncture, insertion of cannula, arterial puncture and umbilical catheter insertion. These findings may have been due to that since the nurses required many trials until they have succeeded in such procedures with the newborns, they required the use of non-pharmacological approaches to relieve pain for them after the procedures. Some painful procedures may need as many as 10 to 15 attempts for successful completion (Moultrie et al., 2017).

Jeong et al. (2014) in Korea, mentioned that the most common procedures where the nurses required the use of non-pharmacological techniques were venipuncture followed by IV catheter insertion. However, Johnston et al. (2011) reported that 46% of the tissue-damaging procedures like venous and arterial punctures were performed without non-pharmacological interventions.

CONCLUSION:

Based on the findings of the current study, it can be concluded that the program was effective in improve nurses' practices in applying non-pharmacological pain management in newborn such as; applying non-nutritive sucking and oral sucrose during arterial puncture, cannulation and injections after the educational program.

RECOMMENDATIONS:

Based on the findings of the present study, the following recommendations are suggested:

1. Continuous training programs should be provided for nurses in the NICUs to keep their practice regarding non-pharmacological pain management in newborns up-to-date.
2. Updated simple Arabic handouts about non-pharmacological pain management in newborns should be available in all NICUs.

3. Encouraging nurses to attend national and international conferences, and workshops about non-pharmacological pain management in NICUs.

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تأثير برنامج تعليمي على مهارات ممرضات الأطفال عن العلاج غير الدوائي للألم في وحدات الرعاية المركزة لحديثي الولادة

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الأطفال - كلية التمريض- جامعة بورسعيد

الخلاصة

يتعرض حديثي الولادة للعديد من الإجراءات المؤلمة خلال فترة العلاج بوحدات الرعاية المركزة للمواليد، في حين ان استخدام طرق العلاج غير الدوائي يمنع ويقلل من هذا الألم. هدفت هذه الدراسة إلي معرفة اثر برنامج تعليمي علي مهارات ممرضات الأطفال عن العلاج غير الدوائي للألم في وحدات الرعاية المركزة لحديثي الولادة. أجريت هذه الدراسة شبه التجريبية علي جميع الممرضات اللاتي كن يعملن في وحدات الرعاية المركزة لحديثي الولادة بمستشفيات بورسعيد (40 ممرضة) وقد تم جمع البيانات باستخدام استمارتي إستبيان وملاحظة. وقد أظهرت نتائج هذه الدراسة أن مهارات الممرضات لتطبيق طرق العلاج غير الدوائي للألم في حديثي الولادة كانت سيئة قبل تطبيق البرنامج التعليمي، بينما بعد تطبيقه تحسنت مهارتهن في تطبيق طرق العلاج غير الدوائي في نقاط معينة وهي عند سحب عينة دم وريدية أو شريانية، تركيب كانيولا، وتركيب قسطرة بالسرة.. وقد أوصت هذه الدراسة بضرورة أن يكون طاقم التمريض القائم برعاية حديثي الولادة على دراية ومدرب على طرق العلاج غير الدوائي للألم لحديثي الولادة من خلال البرامج التدريبية المستمرة، والمؤتمرات سواء المحلية أو الدولية، بالإضافة إلى ورش العمل حول تقييم وطرق العلاج غير الدوائي للألم في حديثي الولادة.

الكلمات المرشدة: غير الدوائي، علاج الألم، وحدات الرعاية المركزة لحديثي الولادة، ممرضات الأطفال