

Impact of an Educational Program for Pediatric Nurses on Non-Pharmacological Pain Management in Hospitalized Children

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Abstract: Hospitalized children suffer from a variety of types of pain which are not always adequately managed. The non-pharmacological methods may help relieving their pains. The aim of the study was to investigate the impact of an educational intervention program in pain management on nurses' self-reported use of non-pharmacological methods for preschool and school age children's pain relief. This quasi-experimental study was implemented on 52 nurses working in the pediatric wards affiliated to Port-Said, Port-Fouad, El-Nasr, and El-Tadamon General Hospitals in Port-Said city. A self-administered questionnaire form was used to collect data regarding nurse's personal characteristics, knowledge regarding pain in children, and self-report of the use of non-pharmacological methods. An educational program was developed and to improve their related knowledge and practice. The evaluation of the effect of the program was done by comparing pre to 3-month post findings. The fieldwork was carried out from September 2011 to January 2012. The results demonstrated very low nurses' knowledge of non-pharmacological methods for pain management before the intervention, with statistically significant improvements after the intervention ($p < 0.001$). Similarly, nurses' adequate practice improved in cognitive behavioral methods ($p = 0.006$), and physical and emotional methods ($p < 0.001$). Multivariate analysis identified the attendance of the intervention program as the only independent predictor of knowledge score improvement, while knowledge score was the only independent predictor of the improvement in practice score. The study concludes that training nurses in the use of non-pharmacological methods of pain management in hospitalized children has a positive impact on their related knowledge and practice. Hence, similar training programs should be implemented in similar settings. The issue should also be incorporated in nursing schools' curricula. Further confirmatory research is suggested using more objective methods such as direct observation.

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1. Introduction

According to the international association for the study of pain, "pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage"⁽¹⁾. Pain is usually caused by trauma, disease, medical procedure, or surgery⁽²⁾. The perception of pain in pediatrics is complex, and entails physiological, psychological, behavioral, and developmental factors.⁽³⁾ Since 2004, pain has been considered in some hospitals as the fifth vital sign in recognition of the importance of pain management and consequently more integrated pain management strategies are needed⁽⁴⁾.

Many hospitalized children suffer from a variety of types of pain which are not always adequately managed^(5, 6). Assessment of pain in children can be achieved by self-report, e.g., verbal report of pain and faces scales, by observation of behaviors, e.g. crying and grimacing, or by physiological changes, e.g., increases in blood pressure or heart rate. Preschool and school-age children can describe pain and relate it to a body part as well as quantify the pain intensity. They fear body harm and have an awareness of death.

Therefore they may appear to overreact to illness or injury. Additionally, they remember previous pain experiences, which will affect the child's response. The child's culture, gender and cognitive abilities will also affect the pain experience^(7, 8).

Since pain, especially in children is multidimensional, with physical, psychological, and behavioral aspects, professional and scientific developments in pain relief have emphasized the need to use both pharmacological and non-pharmacological interventions⁽⁹⁾. The non-pharmacological methods are widely accepted as strategies that may be used independently with mild pain or as a complement to pain medication for moderate or severe pain to ensure adequate relief⁽¹⁰⁾. These methods are divided into five categories; cognitive-behavioral, physical, emotional support, helping with activities of daily living and creating a comfortable environment⁽¹¹⁾.

There is a wide range of evidence of the effectiveness of non-pharmacological methods for relieving children's pain^(12, 13, 14, 15). Moreover, the use of non-pharmacological methods can help reduce opioid intake and the potentially harmful physiological

and psychological responses to pain^(16,17).

Nurses are responsible for the assessment of children's pain; they are, therefore, in the best position to intervene using a variety of approaches to pain management. Nursing staff trained in using non-pharmacological pain-relief methods may use them independently as part of pain management, and in so doing they are not restricted by physicians' prescriptions and may develop an integrative approach to nursing care⁽¹⁸⁾. However, nursing education in pain management, including the use of non-pharmacological methods is still inadequate⁽¹⁹⁾ and this inadequacy in education has been claimed to be one of the major barriers to effective pain relief^(20,21). Therefore, education in pain management for healthcare professionals at all levels has been identified repeatedly as an important step towards changing ineffective pain management practices.

Aim of the study

The aim of the study was to investigate the impact of an educational intervention program in pain management on nurses' self-reported use of non-pharmacological methods for preschool and school age children's pain relief. It was hypothesized that the educational program will improve nurses' knowledge and will consequently increase their use of non-pharmacological pain relief methods.

Subjects and Methods

Design and setting:

A quasi-experimental one group pre-and post-test design was used in this study which was implemented in the pediatric wards affiliated to Port-Said, Port-Fouad, El-Nasr, and El-Tadamon General Hospitals in Port-Said city.

Sample:

All pediatric nurses working in the previously mentioned settings were included in the study sample. Their total number was 52. This sample size was large enough to demonstrate an improvement in the knowledge or practice of nurses concerning the use of non-pharmacological approaches to pain management of 30% or higher, with a Relative Risk (RR) of improvement of 2, at 95% level of confidence and 80% power, with compensation for a dropout rate of about 10% using the sample size equation for the difference between two proportions (EpiInfo 6.04 software program).

Data collection tools:

The researcher used a self-administered questionnaire form used which was previously validated in Finland⁽¹¹⁾, China⁽²²⁾, and Singapore⁽²³⁾. The questionnaire consisted of three parts. The first part included the nurse's personal characteristics such as age, level of education, years of experience, marital status, and attendance of training in pediatric pain. The

second part was for assessment of nurse's knowledge regarding pain in children such as definition of pain, causes, signs and symptoms, tools of assessment and role of the nurse in pain management. The third part consisted of nurse's self-report of the use of non-pharmacological methods to relieve children pain. These methods include cognitive-behavioral methods (e.g. imagery, distraction, relaxation, breathing technique and positive reinforcement), physical methods (e.g. thermal regulation, massage, and positioning), and emotional support (presence, reassurance, and touch). The tool items were checked on a 3-point Likert scale: "never," "sometimes," and "always."

The knowledge items were scored 1 for correct and 0 for incorrect responses. The scores were summed and converted into a percent score. The nurse's knowledge was considered as satisfactory if the percent score was 60% or higher, and unsatisfactory if less. For reported practice, the items were scored 0 to 2 from never to always. The scores were summed and converted into a percent score. The practice was considered adequate if the percent score was 75% or higher (corresponding to the point midway between always and sometimes), and inadequate if less.

Pilot study:

Before starting the pilot, and in order to ensure the validity of the use of the questionnaire in the study setting, professional opinion was sought from an expert panel in nursing. Then, the pilot study was carried out on five nurses working in pediatric wards to assess the applicability of the tools. The necessary modifications were done in terms of rewording and rephrasing some items for more clarity. The tool reliability was tested through assessment of its internal consistency. It proved to have good reliability with Cronbach alpha coefficient 0.652, which is quite acceptable as compared with similar tools⁽²⁴⁾. The pilot subjects were not included in the main study sample.

Fieldwork:

A permission to conduct the study was obtained from the directors of the hospitals after explanation of the purpose of the study and its maneuvers. The researcher carried out the fieldwork through assessment, planning, implementation, and evaluation phases.

The assessment phase started by meeting with the nurses of each hospital, explaining to them the importance of the study and its procedures, and inviting them to participate. The self-administered questionnaire was handed to them and collected upon completion.

Then, the planning phase involved analysis of the collected data in order to identify the most important topics to be addressed in the educational material. The researcher then developed an educational program aimed at improving nurses' knowledge and

practice of non-pharmacological approaches to pain management in children. The program covered theory and practice. The theoretical part included definition of pain, causes, signs and symptoms, factors affecting child's perception, indicators of child's pain and tools of pain assessment. The practical part was about non-pharmacological pain management methods as cognitive-behavioral methods (e.g., imagery, distraction, relaxation, breathing technique, positive reinforcement), physical methods (e.g., thermal regulation, massage, positioning), emotional support (e.g., presence, comforting, reassurance, touch) and creating a comfortable environment. The researcher also prepared an illustrative booklet to help participants self-learning. The booklet titled "methods of non-pharmacological pain management in pre-school and school-aged children" was specifically developed and printed for this research by the investigator based on a review of literature and the results of the assessment phase.

The implementation phases consisted of three sessions, two for the theoretical part and the last for the practice part. The program comprised two components: provision of a self-learning booklet on pain and pain management, and a lecture that included discussion. Although the focus was on non-pharmacological methods, additional information on the most commonly used tools for preschool and school-aged children's pain assessment was addressed in the booklet. The booklet was distributed to nurses' at the start of the lecture, and they were encouraged to read it after the lecture and use these methods in their practice.

The evaluation phase was carried out after three months to measure the effect of the intervention on nurses' knowledge and practice of non-pharmacological approaches to pain management in children. This was done using the same self-administered questionnaire form. The fieldwork was carried out from September 2011 to January 2012.

Ethical considerations and human rights:

The study protocol was approved by the pertinent committees in the Faculty of Nursing. Permissions to carry out the study were secured from official authorities in the designated hospitals. Informed consents were obtained from the nurses before participation in the study after being informed about their right to withdraw from the study at any time without giving any reason. The collected data were strictly confidential, and would not be disclosed for any reason, and were used only for research purposes. No harmful maneuvers were performed, and no foreseen hazards are anticipated from conducting the study.

Statistical analysis: Data entry and statistical analysis were done using SPSS 16.0 statistical software package. Qualitative categorical variables were compared using chi-square test. Whenever the expected

values in one or more of the cells in a 2x2 tables was less than 5, Fisher exact test was used instead. In order to identify the independent predictors of knowledge and practice scores, multiple linear regression analysis was used after testing for normal distribution and homoscedasticity, and analysis of variance for the full regression models were done. Statistical significance was considered at p-value <0.05.

3. Results

The study sample consisted of 52 nurses with no dropouts (response rate 100%). Nurses' age ranged between 20 and 57 years, with a mean 30.5 ± 8.6 years, and their experience in pediatrics ranged from 1 to 35 years (Table 1). Only about one-fifth of the nurses had a bachelor degree (19.2%) and attended training courses in pain in children (19.2%).

Nurses' knowledge of pain the non-pharmacological methods for its management was very low before the intervention (Table 2). This was particularly evident regarding the psychological causes of pain, nurse role in pediatric pain, and the environmental approach in its management, where none of them had satisfactory knowledge. Meanwhile, nurses' knowledge showed statistically significant improvements after the intervention. This was evident in all areas, with the only exception related to the age at which child starts feeling pain, which demonstrated significant decline. Overall, only 7.7% of the nurses had satisfactory knowledge before the program intervention; this increased to 61.5% after the intervention, and the difference was statistically significant ($p < 0.001$).

As for nurses' practice, Table 3 shows that the cognitive behavioral methods most commonly used pre and post intervention as reported by the nurses' were imagery and distraction. Playing games, watching TV programs and practicing hobbies were the most common methods used by the nurses' to distract the children from pain before the intervention. At the post-intervention phase, improvements were revealed in all areas of cognitive-behavioral approaches. However, the difference reached statistical significance in almost all imagery areas and in the playing games and jokes of the distraction approach. Overall, the nurses with adequate reported practice of cognitive-behavioral approached rose from 36.5% before the intervention to 63.5% at the post-intervention phase ($p = 0.006$).

Table 4 shows low rates of utilization of physical and emotional methods and of involvement of child's family in pain management before the intervention. Meanwhile, the use of environmental approaches was quite high. At the post-intervention phase, all the areas demonstrated statistically significant improvements. The only exception was

related to encouraging family to get child's objects, which showed improvement but with no statistical significance. Massage (46.2%) was the most commonly used physical method, while touch (55.8%) was the most frequently used emotional method after the intervention. The total improvement was more evident in emotional (80.8%) compared to physical (55.8%) approaches after the intervention as reported by nurses. The table also illustrates that the percentage of nurses with total adequate practice increased from 36.5% before the intervention to 75.0% after the intervention, and the difference was statistically significant ($p < 0.001$).

Table 5 presents the multivariate regression models for nurses' knowledge and practice scores. It is evident that the attendance of the intervention program was the only statistically significant independent predictor of the change in knowledge score, and it explains 68% of the score improvement. As regards practice, the table shows that the improvement in knowledge score was the only independent predictor of the improvement in practice score, and it explained 22% of the improvement in this score. Meanwhile, none of the nurses' characteristics influenced their knowledge or practice scores.

Table 1: Personal characteristics of nurses in the study sample (n=52)

	Frequency	Percent
Age (years):		
<30	28	53.8
30+	24	46.2
Range	20.0-57.0	
Mean±SD	30.5±8.6	
Nursing qualification::		
Bachelor	10	19.2
Technical institute diploma	7	13.5
Secondary nursing diploma	35	67.3
Nursing qualification::		
Bachelor	10	19.2
Diploma	42	80.8
Marital status:		
Unmarried	16	30.8
Married	36	69.2
Having children:		
No	6	16.2
Yes	31	83.8
Experience (years):		
<5	21	40.4
5+	31	59.6
Range	<1-35	
Mean±SD	8.4±7.9	
Attended training courses in:		
Pain in children	10	19.2
Non-pharmacologic pain management	6	11.5

Table 2: Nurses' knowledge of pain and the non-pharmacologic methods for its management before and after the intervention

Satisfactory knowledge (60%+) of:	Time				X ² Test	p-value
	Pre (n=52)		Post (n=52)			
	No.	%	No.	%		
Definition of pain	7	13.5	32	61.5	25.64	<0.001*
Age child starts feeling pain	10	19.2	2	3.8	6.03	0.01*
Physiological causes of pain	8	15.4	42	80.8	44.53	<0.001*
Psychological causes of pain	0	0.0	9	17.3	Fisher	0.003*
Total causes of pain	0	0.0	21	40.4	26.31	<0.001*
Physiological changes with pain	8	15.4	43	82.7	47.13	<0.001*
Facial pain symptoms	9	17.3	41	78.8	39.44	<0.001*
Anxiety signs due to pain	22	42.3	49	94.2	32.36	<0.001*
Assessment of pain	2	3.8	38	73.1	52.65	<0.001*
Nurse role in pediatric pain	0	0.0	15	28.8	17.53	<0.001*
Non-pharmacologic pain management:	3	5.8	19	36.5	17.76	<0.001*
Behavioral	3	5.8	19	36.5	17.76	<0.001*
Somatic	7	13.5	16	30.8	4.52	0.03*
Emotional	2	3.8	15	28.8	11.88	0.001*
Environmental	0	0.0	6	11.5	Fisher	0.03*
Total non-pharmacologic pain management	1	1.9	17	32.7	17.20	<0.001*
Benefits of non-pharmacologic pain management	7	13.5	16	30.8	4.52	0.03*
Total knowledge:						
Satisfactory	4	7.7	32	61.5		
Unsatisfactory	48	92.3	20	38.5	33.31	<0.001*

(*) Statistically significant at $p < 0.05$

Table 3: Nurses' practice of cognitive-behavioral methods of pain management before and after the intervention

Used sometimes/always	Time				X ² Test	p-value
	Pre (n=52)		Post (n=52)			
	No.	%	No.	%		
Use of cognitive-behavioral methods						
Imagery:						
Encourage child to imagine +ve things	26	50.0	40	76.9	8.13	0.004*
Nice place	26	50.0	41	78.8	9.44	0.002*
Nice trip	27	51.9	38	73.1	4.96	0.03*
Favorite activity	30	57.7	39	75.0	3.49	0.06
Total imagery (adequate: 75%+)	6	11.5	21	40.4	11.26	0.001*
Distraction:						
Try to distract child	29	55.8	34	65.4	1.01	0.32
Reading books, magazines	27	51.9	32	61.5	0.98	0.32
Talking about daily life events	29	55.8	34	65.4	1.01	0.32
Playing games	30	57.7	42	80.8	6.50	0.01*
Watching TV	30	57.7	39	75.0	3.49	0.06
Listening to music	29	55.8	38	73.1	3.40	0.07
Hobbies	30	57.7	37	71.2	2.06	0.15
Jokes	27	51.9	37	71.2	4.06	0.04*
Total distraction (adequate: 75%+)	12	23.1	32	61.5	15.76	<0.001*
Relaxation	12	23.1	15	28.8	0.45	0.50
Breathing technique	12	23.1	14	26.9	0.21	0.65
Positive re-enforcement	17	32.7	22	42.3	1.03	0.31
Total cognitive (adequate: 75%+)	19	36.5	33	63.5	7.54	0.006*

(*) Statistically significant at p<0.05

Table 4: Nurses' practice of physical and emotional methods of pain management before and after the intervention

Used sometimes/always	Time				X ² Test	p-value
	Pre (n=52)		Post (n=52)			
	No.	%	No.	%		
Physical methods:						
Thermal regulation	6	11.5	15	28.8	4.83	0.03*
Massage	7	13.5	24	46.2	13.28	<0.001*
Positioning	6	11.5	19	36.5	8.90	0.003*
Total physical (adequate: 75%+)	12	23.1	29	55.8	11.64	0.001*
Emotional methods:						
Presence	8	15.4	28	53.8	16.99	<0.001*
Comforting	14	26.9	24	46.2	4.15	0.04*
Touch	10	19.2	29	55.8	14.81	<0.001*
Environmental:						
Creating comfortable environment	42	80.8	49	94.2	4.31	0.04*
Make child feel comfortable	42	80.8	49	94.2	4.31	0.04*
Suitable room temperature	40	76.9	48	92.3	4.73	0.03*
Decrease noise	40	76.9	50	96.2	8.25	0.004*
Encourage family to get child's objects	35	67.3	42	80.8	2.45	0.12
Change room décor	32	61.5	42	80.8	4.68	0.03*
Total environmental (adequate: 75%+)	18	34.6	46	88.5	31.85	<0.001*
Ask family to give suggestions for pain relief (adequate: 75%+)	6	11.5	14	26.9	3.96	0.047*
Encourage family participation in pain management (adequate: 75%+)	14	26.9	24	46.2	4.15	0.04*
Total emotional (adequate: 75%+)	21	40.4	42	80.8	17.76	<0.001*
Total practice:						
Adequate	19	36.5	39	75.0		
Inadequate	33	63.5	13	25.0	15.59	<0.001*

(*) Statistically significant at p<0.05

Table 5: Best fitting multiple linear regression model for knowledge score

	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper
Knowledge score:							
Constant	-12.05	3.39		-3.55	.001	-18.81	-5.29
Time (reference: pre)	26.68	2.14	.83	12.48	<0.001	22.42	30.94
r-square = 0.68 Model ANOVA: F=155.85, p<0.001 Variables entered and excluded: age, qualification, experience, training courses							
Practice score:							
Constant	55.02	3.05		18.04	<0.001	48.94	61.10
Knowledge score	.44	.09	.48	4.70	<0.001	.25	.63
r-square = 0.22 Model ANOVA: F=22.08, p<0.001 Variables entered and excluded: age, qualification, experience, training courses, medication, severity, intervention							

4. Discussion

This study was carried out to test the research hypothesis that the implementation of an educational program will improve nurses' knowledge of non-pharmacological pain relief methods, which would lead to more utilization of these approaches among them. The study results lead to acceptance of this hypothesis since nurses' knowledge improved significantly, and their practice has also improved due to the improvement of their knowledge.

According to the current study findings, only four out of the 52 nurses had satisfactory knowledge of pain and its management at the pre-intervention phase. The finding is quite alarming given the important role of the nurses in pain assessment and management, which is considered as critical in certain situations as highlighted by *Tringali et al (2013)*⁽²⁵⁾. Moreover, *Ersk and Poe (2004)*⁽²⁶⁾ emphasized that nurses have a key role in effective pain management through accurate assessment, prompt intervention, and evaluation of pain relief measures. Nonetheless, the low levels of satisfactory knowledge in the study sample may be attributed to their qualifications which are mostly diploma, in addition to the low percentages of training opportunities in pain management among them.

The implementation of the present study educational program led to significant improvements in nurses' knowledge about pain and its management. The improvement was demonstrated in all areas and in the total knowledge. This indicates that the intervention program achieved the first part of the research hypothesis concerning improving nurses' knowledge. The impact of the intervention on nurses' knowledge was confirmed through multivariate analysis, which identified that the attendance of the educational program was the only independent predictor of the improvement in nurses' knowledge scores regardless their personal or job characteristics. The results are in agreement with the findings reported by similar educational endeavors in Mexico⁽²⁷⁾ and in the United Kingdom⁽²⁸⁾.

The aim of improving the knowledge of the health professionals is to transfer this knowledge to their practice⁽²⁹⁾. This was actually the second part of our research hypothesis, which assumed that improving nurses' knowledge will have a positive impact on their practice. This was confirmed through the multivariate analysis which identified the knowledge score as the single independent statistically significant positive predictor of the improvement in nurses' practice scores. The intervention by itself could not predict the practice score, but it acted through its positive impact on nurses' scores, which was consequently reflected on their practice. The finding goes in line with *De Rond et al (2001)*⁽⁵⁾ who attributed the inadequate nurses' management of pain to their insufficient knowledge

about pain and pain management.

The current study results revealed that nurses' self-reported practice concerning the use of non-pharmacological methods for relieving pediatric pain has significantly improved after the intervention. However, some areas demonstrated better improvements than others. Thus, the use of emotional and distraction methods were more frequently used after the intervention, compared to imagery and physical approaches. The reason for the more frequent use of these methods might be that they are easy to carry out, and the distraction methods are already used by nurses' and parents for pain relief in children. In congruence with this, *Lawes et al (2008)*⁽²⁸⁾ found that the techniques of distraction were being used in the majority of cases to help the child to cope with pain. A more recent study has also demonstrated that the use of audiovisual distraction was successful in reducing the pain perception among patients during painful procedures⁽³⁰⁾.

On the other hand, the present study findings showed significant but less improvements in nurses' reported use of the methods of massage, positioning, thermal regulation, as well as of emotional support by touch, presence, and comforting. There are several explanations for these results. Firstly, this might be due to the fact they were more cautious about using physical methods such as massage and thermal regulation, as these might not be part of routine care in the ward, which might carry some responsibilities to their sequels. Secondly, nurses might not have realized enough that simple methods such as positioning, touch and presence can help reduce children's pain. Nonetheless, these approaches showed improvement after the intervention, which is in agreement with *He et al (2008)*⁽³¹⁾ who similarly reported statistically significant improvements in participants' reported use of the methods of thermal regulation, massage and positioning to relieve postoperative pain in children. More recently, *Smith et al (2011)*⁽³²⁾ showed that focusing on "comfort" positioning and use of distraction/alternative focus during painful procedures to pediatric patients can improve the care offered to these children.

According to the present study findings, the use of environmental comforting factors was the most widely used by nurses both before and after the intervention, with significant improvements in all its elements after the intervention. The finding is quite expected since it involves many of the routine approaches utilized at hospital and even in daily life to comfort any person suffering from pain. In congruence with this, *Logan et al (2012)*⁽³³⁾ showed the influence of environmental and ecological factors on management of pediatric pain.

Although the use of communication and more

involvement of child's family in the approaches to pain management showed significant improvements in the present study, they still were the least used by the study nurses. This might be attributed to the fact that the notion of involving patient's family in the management process and in decision making is still not fully accepted by some of the nurses in the setting, who are convinced with the full responsibility of the health care provider for the hospitalized patient. Nonetheless, the improvement after the intervention is in agreement with previous similar studies which demonstrated increases in nurses' reported use of encouragement of parents to participate in the pain management of their children and its importance since parents not only possess a unique knowledge of their child, but they also have experience in detecting subtle changes in their child's behavior^(34, 35). Hence, parental involvement, among other strategies, is essential in effective management of pain and stress among children⁽³⁶⁾.

Conclusion and Recommendations

The study findings lead to the conclusion that training nurses in the use of non-pharmacological methods of pain management in hospitalized children has a positive impact on their related knowledge and practice. Since nurses can implement these simple, inexpensive, and effective approaches independently and without physician order, it is recommended that similar training programs be implemented in similar settings. The issue should also be incorporated in nursing schools' curricula. Nevertheless, an important limitation of this study is that the results depended on self-reporting, which might suffer some bias. Therefore, further confirmatory research is suggested using more objective methods such as direct observation.

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