Assessment of Nurses' Performance for Pain Management of Neonates Undergoing Heel Stick Puncture

Zeinab Shaban Ibrahem [*], Wafaa Elsayed Ouda[**], Orban Ragab Bayoumi [**]
* B.S.c Nursing Science, Faculty of Nursing, Fayoum University
**Professor of Pediatric Nursing Department Faculty of Nursing-Ain Shams University

Abstract

Background: Neonatal pain management is a professional practice, education and research opportunity that nurses need to explore, evaluate and refine continuously within the rapidly changing technological environment of the Neonatal Intensive Care Units (NICUs). **Aim of the study:** This study aimed at assess nurses' performance regarding pain management of neonates undergoing heel stick puncture. **Design:** A descriptive design was used to conduct this study. **Setting:** This study was conducted at the Neonatal Intensive Care Unit in El-Fayoum General Hospital. **A convenience sample** composed of 70 nurses who were working at the previously mentioned study settings and 70 neonates during the study period. **Tools:** Pre-designed Questionnaire Sheet, Observational Checklists, Likert Type Rating Scale. and Neonatal Infant Pain Scale. **Results:** It was found that two thirds of the studied nurses had good knowledge regarding heel stick puncture and pain management, most of them had incompetent practices regarding heel stick puncture and pain management of the neonates. Majority of nurses had positive attitude regarding pain management of neonates, and three fifths of the neonates had mild to moderate pain. **Conclusion:** Nearly more than two thirds of the studied nurses had good knowledge and most of them had incompetent practices regarding heel stick puncture and pain management of the neonates, Also the majority of the studied nurses had positive attitude regarding pain management of neonates undergoing heel stick puncture. **Recommendation:** Periodic assessment of nurse's performances regarding pain management of neonates undergoing heel stick puncture.

Key words: Heel Stick Puncture, Neonatal Intensive Care Units, Nurse's Performance, Pain Management.

Introduction:

Neonatal nurse is professional with special training, skills, and knowledge in the care of neonates and their families. The progresses of science and technology in Neonatal Intensive Care Units (NICUs) have contributed to the increased survival of neonates ***(Franck et al., 2020).*** However, factors such as the increase in both number of equipment and invasive procedures, the constant need for light, the presence of ambient noise and the required excessive manipulation during care have resulted in a number of adverse effects. Subsequently, these effects trigger changes in the development of neonates, especially in preterm neonates ***(Alebel et al., 2020).***

The heel stick is now the most common way to draw neonate's blood for neonate screening tests and usually done within 3 to 7 days after birth. The purposes of heel stick to discover certain disease such as hypothyroidism, phenylketonuria, galactosemia and sickle cell disease **(Shoraka et al., 2020).**

Procedures of heel sticks cause pain and can have adverse effects on the neonates. The resultant effect of neonatal pain can be serious, potentially leading to physiological, behavioural, and cognitive changes particularly when pain is persistent. Additionally neonates in pain have been shown to have decreased heart rate and oxygen consumption, erratic respiration, hormonal and metabolic problems and a changes in facial expressions **(Ayede, 2020).**

Inadequate pain management in neonatal life impairs neuro-developmental outcome. It alters pain thresholds, physiological responses and stress- or pain-related behavior beyond early infancy. Therefore, pain management in neonates should not be driven by ethics or empathy but it should be viewed as part of normal medical and nursing care. New treatment modalities, including non-pharmacological and pharma-cological strategies, will need to be developed and validated **(Forest & Harris-Haman, 2022).** There are several effective non pharmacological pain management, including; oral sucrose/glucose, breastfeeding, non-nutritive sucking (NNS), kangaroo mother care/ skin-to-skin care, nesting, heel worming, touch, music therapy, massage, and swaddling during heel sticks will provide non pharmacological effects to the neonate and control the pain **(Nimbalkar et al., 2020).**

Improper heel-stick technique can damage the structures of the foot, including the calcaneus bone and soft tissues. In fact, some reports have documented difficulties walking later in life. It is safe to perform a heel stick if the puncture site is limited to the medial and lateral planter aspects of each heel pad, specifically medial to a visual line drawn from the middle of the big toe extending posterior to the heel or lateral to a line drawn from between the fourth and fifth toes and extending posterior to the heel. Repeated punctures, bruising, or erythema limit the available area for punctures, especially in premature infants who may have blood drawn multiple times or very tiny heels **(Shayani & Marães 2022)**.

Significance of the study:

Prevention of pain is important not only because it is an ethical expectation but also because repeated painful exposures can have deleterious consequences. Nurses play an important role in providing care for neonate undergoing heel stick puncture. Nurses should be assess, provide care and manage pain of neonates during heel stick puncture by different methods such as swaddling, administration of sucrose, nesting, nonnutritive sucking, foot massage. So, improving the nurses' knowledge, practices and attitudes are mandatory **(Goto et al., 2020).**

Aim of the study:

This study aimed to assess nurses' performance regarding pain management of neonates undergoing heel stick puncture.

Research Questions:

- What is the nurses' knowledge regarding pain management of neonates undergoing heel stick puncture?
- What is the nurses' practices regarding pain management of neonates undergoing heel stick puncture?
- What is the nurses' attitudes regarding pain management of neonates undergoing heel stick puncture?

Subject and Methods

The methodology of this study was presented under the following four designs:

I: Technical Design
II: Operational Design
III: Administrative Design
IV: Statistical Design

I: Technical Design

It included research design, setting, subject and tools of data collection

A. Research Design

Descriptive design was used to conduct this study.

B. Research Setting

The current study was conducted at Neonatal Intensive Care Unit in EL- Fayoum General Hospital affiliated to the Ministry of Health. The NICU unit is located in the third floor and is consisted of eight rooms; each room including 9 incubators so, the total number of incubators was 72.

C. Research Subject

A convenience sample composed of 70 neonatal nurses regardless of their age, gender, qualifications and experiences, who were working at the previously mentioned settings, and agreed to participate in the study. Also, all available neonates composed of 70 neonates undergoing heel stick puncture regardless their gestational age, gender and birth weight durong the research period.

D. Tools of Data Collection:

I. Pre-designed Questionnaire Sheet

It was designed by the researcher based on extensive recent literatures and written in an Arabic language to assess nurses' knowledge regarding pain management of neonates undergoing heel stick puncture. It was written in the form of open and close ended questions and consisted of the following parts:

Part 1- Characteristics of the studied nurses. It included 6 questions (age, gender, marital status, qualifications, years of experiences, training courses).

Part 2- Characteristics and medical history of the neonates, that included 6 questions (gestational age, gender, birth weight, mode of delivery, medical diagnosis and duration of hospital stay).

Part 3- Nurses' knowledge regarding pain related to heel stick puncture. It was written in the form of close ended questions (included yes or no and MCQ). The questions composed of 31 questions (related to definition of heel stick puncture, causes of heel stick puncture, times of heel stick get puncture per week, sites of heel stick puncture, complications of heel stick puncture, nurse`s role during heel stick puncture, pharmacological pain management methods, non-pharmacological pain management methods used for neonate during heel stick puncture, benefits of using non-pharmacological pain management methods namely; kangaroo position, warm compresses, swaddling, nesting, neonatal massage and sucrose administration). the nurses' responses, was categorized as Good knowledge: if scores more than 75%, Average knowledge: if scores from 60-75% and Poor knowledge: if scores less than 60%

II. Observational Checklists:

The observational checklists were adopted from **Anand et al., (2017) and Yilmaz & Inal (2020).** It was used to assess nurses' practices regarding pain management of neonates undergoing heel stick puncture. The observational checklists included 6 procedures namely; heel stick puncture procedure (10 steps), kangaroo care (8 steps), swaddling (8 steps), nesting (8 steps), neonatal massage (12 steps) and sucrose administration (7 steps).

Nurses were directely observed and their practices were evaluated during their actual working shifts, the practices was considered as competent practices if score≥85% and incompetent practices if score < 85%.

III. Likert Type Rating Scale:

It was used to assess nurses' attitude regarding pain management of neonates undergoing heel stick puncture. It included 13 statements regarding pain management of neonates undergoing heel stick puncture, the nurses' attitude was considered positive attitude if score ≥ 70%, and negative attitude if score < 70%.

IV: Neonatal Infant Pain Scale (NIPS):

It was adopted from ***Chen et al., (2020),*** and used to assess level of pain of neonates during heel stick puncture using non pharmacological pain management. The neonatal infant pain scale is a behavioral scale and can be utilized with both full-term and pre-term infants. The tool was used to assess the behaviors that nurses have described as being indicative of infant pain or distress. It is composed of (8) indicators namely; Facial expression, cry, breathing patterns, arms legs movements, state of arousal, heart rate and oxygen saturation**.** NIPS scoring as following: No to mild pain (0-2), Mild to moderate pain (3-4) and Severe pain (>4).

II: Operational Design:

Included preparatory phase, content validity and reliability, pilot study, field work and ethical considerations.

Preparatory phase:

It included reviewing of related literature and theoretical knowledge of various aspects of the study using articles, periodicals, books and internet to get acquainted with the research problem and to develop the study tools.

Validity and Reliability:

Content validity was tested through panel of experts 3 from pediatric nursing department, to ensure the validity of comprehensiveness, accuracy, clarity and relevance. The necessary modifications were done according to their comments. Reliability of the tools were tested using Cronbach Alpha test (0.737 for the questionnaire sheet, 0.860 for the observational checklists. and likert type rating scale.

Pilot study:

A pilot study was conducted on 10% of the total sample size (7 nurses) and (7 neonates) based on sample criteria to test feasibility and applicability of the tools and to assess the time required to fulfill the tools and find out the possible obstacles and problems that might face the researcher and interfere with data collection. The necessary modifications were done according to the results of the pilot study. Subjects included in the pilot study were excluded from the study sample.

Field Work:

The current study was conducted at Neonatal Intensive Care Unit in EL- Fayoum General Hospital. The actual fieldwork was carried out for data collection over 6 months started from the beginning of February, 2022 till the end of July, 2022. The researcher started by introducing herself to the nurses, explained the aim and nature of the study and asked them about their expectations. The researcher was available in the study setting during morning and afternoon shifts two days per week during Saturday and Tuesday of each week, to observe the neonates needed to heel stick puncture. The time needed for completing the tools was about 15-20 minutes for questionnaire and 30 minutes for observational checklists and attitude.

Ethical Considerations:

The research approval was obtained from Scientific Researcher Ethical Committee, Faculty of Nursing at Ain Shams University before starting the study. An oral approval was obtained from each study subject after the researcher clarified the aim of the study to gain their confidence and trust. The researcher assured maintaining anonymity and confidentiality of subjects' data. Nurses were informed that their participation is voluntary and that they have the right to withdraw from the study at any time without giving any reasons. The information collected were treated confidentiality and used only for the study purpose.

III: Administrative Design:

Written letter was issued from the Dean of Faculty of Nursing, Ain Shams University to the directors of the previously mentioned study setting to seek their approval for the carrying out the study. An official permission was obtained from director of the study setting, after explanation of the aim, expected outcomes and duration of the study.

IV: Statistical Design:

The collected data was organized, revised categorized, tabulated and statistically analyzed using number and percentage distribution. Statistical analysis was done by the computer using statistical package of social science (SPSS), version 20. The following statistical techniques were used for data analysis: descriptive statistics, frequency, percent distribution, arithmetic mean. Qualitative categorical variable were compared using chi-square test, Pearson correlation test.

Results :

The main findings of this study were summarizes as follows:

Table (1): showed that, age of **37.1%** of the studied nurses was 28: < 33 years old $\bar{X}$ **±SD** was **28.25±4.48**. Also **60.0%** of nurses were married and **44.3 %** of them graduated from technical nursing institute, as well as, **45.7%** of them had experience 3 : < 6 years. **68.6%** of nurses not received training courses about neonatal heel stick puncture.

Table (2): displayed that **70.0%** of neonates had gestational age <37 weeks, **78.6%** of them were males, and **55.7%** of them weighted between 2: < 3 kg at admission. As well as **88.6%** of them delivered by cesarean section, and **64.3%** of neonates had RDS, and also **4.3%** of them had neonatal sepsis, and **52.9%** of them had one week stay in hospital.

Figure (1): indicated that, **64.3%** of the studied nurses had good knowledge regarding neonatal heel stick puncture, while **12.9%** of them had poor knowledge regarding neonatal heel stick puncture and pain management of neonates

Table (3): clarified that **25.7%** and **28.6%** of the studied nurses had competent practices regarding heel stick puncture and swaddling respectively, while **80.0%** and **91.4%** of them had incompetent practices regarding nesting and sucrose administration for the neonates respectively.

Figure (2): showed that majority **(94.3%)** of the studied nurses had incompetent practices regarding heel stick puncture and types of non-pharmacological pain management of the neonates. and the minority **(5.7%)** of them had competent practices.

Figure (3): indicated that **82.9%** of the studied nurses had positive attitude regarding pain management of neonates undergoing heel stick puncture, while **17.1%** of them had negative attitude.

Table (4): showed that **60.0%** of the neonates undergoing heel stick puncture had mild to moderate pain, while **31.4%** of them had severe pain during heel stick puncture.

Table (5): revealed that, there was highly a statically significant corelation between total score level of nurses' knowledge regarding pain management of neonates undergoing heel stick puncture and level of pain of neonates at p-value 0.01, and this table also, reflected negative correlation between total score level of nurses' knowledge and level of pain of neonates. Also, there was no statically significant relation between total score level of nurses' practices and their attitude regarding pain management of neonates undergoing heel stick puncture and level of pain of neonates. Also, this table reflected positive correlation between neonates' level of pain and nurses' practices and their attitude.

Table (1): Distribution of the Studied Nurses according to their Characteristics (n=70).

Nurses' Characteristics	Number	Percentage
Age in years		
18: < 23	18	25.7
23: < 28	20	28.6
28: < 33	**26**	**37.1**
33: ≤ 38	6	8.6
$\overline{X}$±SD	**28.25±4.48**	
Marital status		
Married	**42**	**60.0**
Single	27	38.6
Divorced	1	1.4
Qualifications		
Technical Nursing Diploma	**31**	**44.3**
Bachelor's in Nursing Science	20	28.6
School of Nursing Diploma	17	24.3
Post Graduate Studies (master/ doctorate)	2	2.9
Years of experience		
< 1	16	22.9
1 : < 3	20	28.6
3 : < 6	**32**	**45.7**
More than 6	2	2.9
Pervious attendance of training courses about neonatal heel stick puncture		
No	**48**	**68.6**
Yes	22	31.3

Table (2): Distribution of the Studied Neonates according to their Characteristics and Medical History (n=70).

Neonates' Characteristics	No	%
Gestational age (weeks)		
< 37	**49**	**70.0**
37: < 38	21	30.0
Gender		
Male	**55**	**78.6**
Female	15	21.4
Weight (Kg)		
1 : < 2	31	44.3
2: < 3	**39**	**55.7**
Mode of delivery		
Cesarean section	**62**	**88.6**
Normal vaginal delivery	8	11.4
Diagnosis		
RDS	**45**	**64.3**
Hyperbilirubinemia	10	14.3
Preterm	7	10.0
Congenital anomalies	5	7.1
Neonatal sepsis	3	**4.3**
Hospital stay/week		
< One week	7	10.0
One	**37**	**52.9**
Two	14	20.0
Three	5	7.1
Four	7	10.0

Figure (1): Percentage Distribution of Total Score Level of Nurses' Knowledge regarding Neonatal Heel Stick Puncture and Pain Management of Neonates.

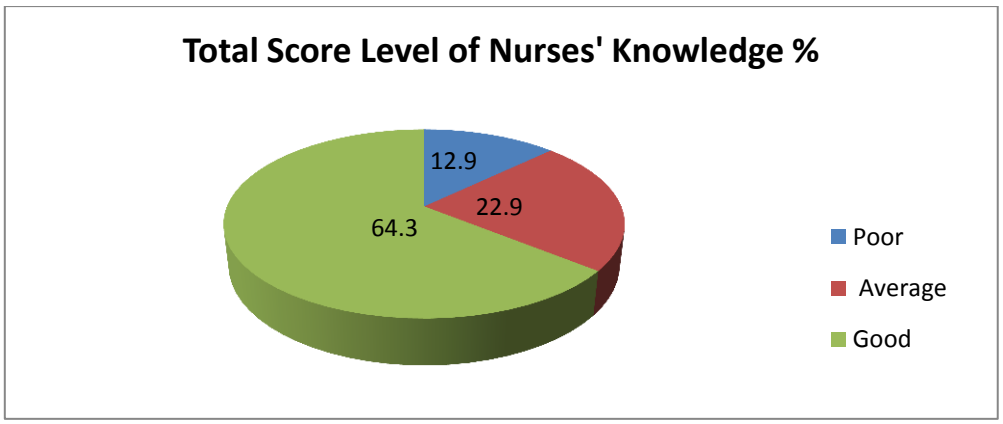

Table (3): Distribution of Total Score Level of Nurses' Practices regarding Neonatal Heel Stick Puncture and Types of Non-pharmacological Pain Management of the Neonates (n=70)

Total Nurses' Practices	Total Score Level of Nurses' Practices			
	Competent		Incompetent	
	No	%	No	%
Heel Stick Puncture	18	**25.7**	52	74.3
Kangaroo Care	20	28.6	50	71.4
Swaddling	20	**28.6**	50	71.4
Nesting	14	20.0	56	**80.0**
Massage	0	0	70	100
Sucrose administration	6	8.6	64	**91.4**

Figure (2): Percentage Distribution of Total Score Level of Nurses' Practices regarding Neonatal Heel Stick Puncture and Types of Non-pharmacological Pain Management of the Neonates.

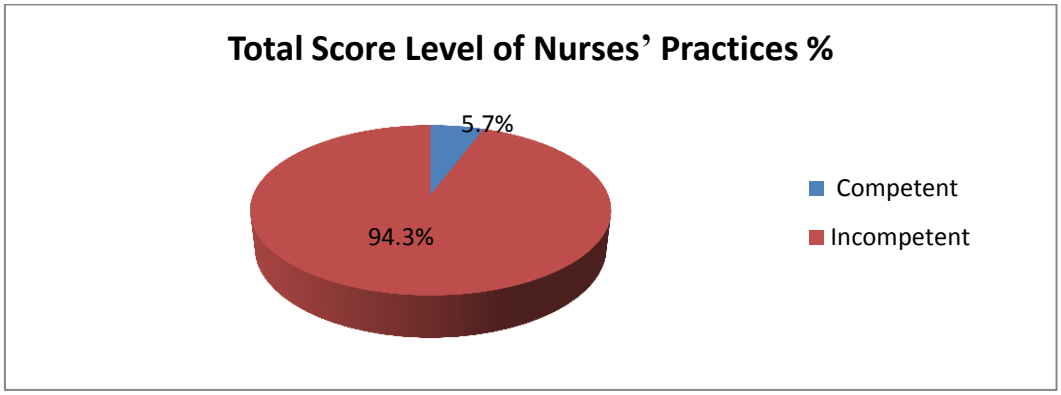

Figure (3): Percentage Distribution of Total Score Level of Nurses' Attitude regarding Pain Management of Neonates undergoing Heel Stick Puncture

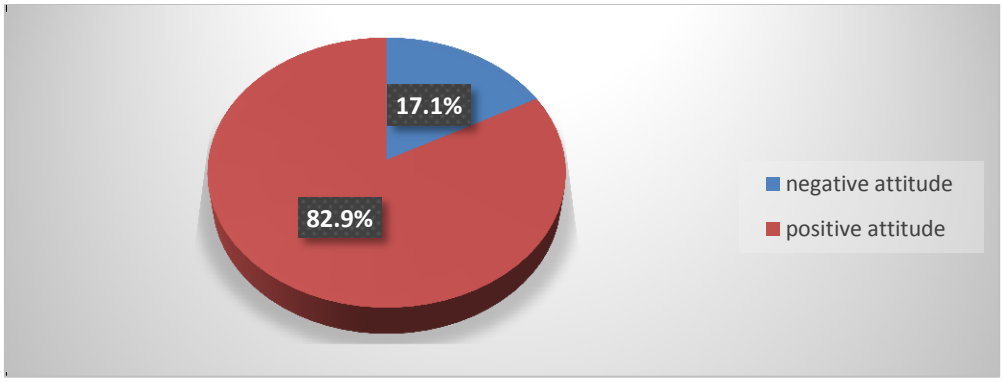

Table (4): Distribution of Neonates according to Level of Pain during Heel Stick Puncture Using Non-Pharmacological Pain Management (n=70)

Level of Pain	No	%
No to mild pain (0-2)	6	8.6
Mild to moderate pain (3-4)	42	**60.0**
Severe pain (>4)	22	**31.4**

Table (5): Correlation between Nurses' knowledge, Practice, Attitude and Level of Pain of Neonates Undergoing Heel Stick Puncture.

Level of Pain	Total Score Level of nurses' Knowledge		Total Score Level of nurses' Practices		Total Score Level of nurses' Attitude	
	r	P-value	R	P-value	r	P-value
No to mild pain (0-2) Mild to moderate pain (3-4) Severe pain (>4)	**-.399****	**.001**	**.112**	**.356**	**.229**	**.056**

**Correlation is highly significant at the 0.01 level (2-tailed).

Discussion:

Table (1) Regarding to age, results of the current study revealed that more than one third of the studied nurses' ages were ranged between 28 and 33 years old ($\bar{X}$ ±SD was 28.25±4.48). This finding was in disagreement with ***Adam et al., (2020),*** in Egypt who carried out a study entitled "Nurses' Perception about Pain Assessment and Management in Neonatal Intensive Care Units / Department of Pediatric Nursing" and found that 65% of the nurses their aged ranged between 20 to 29 years.

This findings agree with ***Mohamed, et al., (2018)*** in Egypt who carried out a study entitled "Effect of Educational Program on Pediatric Nurses' knowledge and practice regarding selected non-pharmacological techniques to relive pain in neonates, and found that 87.8% of the study sample were less than 5 years of experience.

Table (2) Regarding to neonatal gestational age, results of the present study found that, less than three fourths of neonates had gestational age <37 weeks. This finding was in an agreement with ***Aydin & Inal, (2019)***, in Turkey, who carried out a study entitled "Effects of Breastfeeding and Heel Warming on Pain Levels during Heel Stick in Neonates", and found that neonates gestational age, 37 to 41 weeks.

According to neonatal birth weight, results of the present study found that more than half of neonates weighted between 2: < 3 kg at admission. This finding was in an agreement with ***Zhang et al., (2018),*** in China who carried out a study entitled "Neonatal Intensive Care Nurses' Knowledge and Beliefs regarding Kangaroo Care in China" and found that 65.7% of neonates weighted > 2,500. Regarding to neonatal hospital stay, findings of the present study revealed that more than half of them had one week stay in hospital.This finding was in an agreement with ***Zhang et al., (2018)***, who found that 33.3% of neonates had hospital stay from 6 to10 day in hospital.

Figure (1) According to total score level of nurses' knowledge regarding neonatal heel stick puncture and pain management of neonates current study found that about two thirds (64.3.4%) of studied nurses had good knowledge regarding methods of non-pharmacological pain management, while less than one quarter (22.9%) of them had average knowledge and minority (12.9%) of them had poor knowledge regarding methods of non-pharmacological pain management.

Table (3) On investigating nurses' practices about neonatal heel stick puncture, findings of the present study found that only one quarter and more than quarter of the studied nurses had competent practices regarding heel stick puncture and swaddling respectively.

While four fifth and the majority of nurses had incompetent practices regarding nesting and sucrose administration respectively. These findings were in an agreement with results of ***Alburaey, (2020),*** in Saudi Arabia who carried out a study entitled "Pain Assessment and Management by Nurses in Neonatal Intensive Care Unit" and reported that, more than half of the study sample had competent practices about non-pharmacological pain intervention for neonates during procedures.

Figure (2) Regarding to total score level of nurses' practices about neonatal heel stick puncture, findings of the present study found that the majority of the studied nurses had incompetent practices regarding heel stick puncture and the minority of them had competent practices.

These findings were in contrast with results of ***Di Clifford Faugere et al., (2022),*** in Philadelphia who carried out a study entitled "Nurses' Perception of Preterm Infants' Pain and the Factors of their Pain Assessment and Management" and found that the majority of nurses had competent practices regarding heel stick puncture. From the researcher point of view this difference may be related to neonatal heel stick puncture is becoming routine procedure and may be previously studied in their course specification.

Figure (3) According to total score level of the studied nurses' attitude regarding pain management of neonates undergoing heel stick puncture, the present study findings showed that, more than four fifths of the studied nurses had positive attitude regarding pain management of neonates undergoing heel stick puncture, while less than one quarter of the studied nurses had negative attitude regarding pain management of neonates undergoing heel stick puncture. From the researcher point of view, the positive attitudes of some nurses in this study seem to relate to their age and longer experience in NICU**.**

These findings were in an agreement with findings of ***Zeng et al., (2020),*** in China who carried out a study entitled "Non-pharmaceutical Intervention and Pain Management Situation for Neonatal Analgesia" and Found that most of studied nurses don't had a positive attitude toward pain management of neonates.

Table (4) Regarding to neonates level of pain during heel stick puncture using non-pharmacological pain management, results of the present study found that three fifths of the neonates undergoing heel stick puncture had mild to moderate pain, while close to one third of them had severe pain, and the minority of them had no to mild pain.

These findings were in disagreement with results of **Napiorkowska-Orkisz, (2022),** in Olsztyn, who carried out a study entitled "Evaluation of Methods to Minimize Pain in Newborns during Capillary Blood Sampling for Screening" and found that 'no pain in 62.2%, moderate pain in 12.2% and strong pain in 25.6%. From the point of view of researcher when pain goes unrelieved, it can result in cognitive impairment, mental confusion, and a lowered ability to concentrate on the task at hand of nurses' during shift.

Table (5) Regarding to correlation between nurses' knowledge, practices, attitude and level of pain of neonates undergoing heel stick puncture, findings of the current study revealed that, there were highly statically significant relation between total score level of nurses' knowledge regarding pain management of neonates undergoing heel stick puncture and level of pain of neonates at p-value 0.01. This result may be due to that the studied nurses had poor knowledge about pain assessment and intervention methods to minimize pain for neonates, so their weren't had positive attitude toward pain management.

These findings were in an agreement with ***De Clifford Faugere et al., (2022),*** who found that nurses' attitudes and perceptions influenced their pain assessment practices, which predicted their implementation of interventions.

Conclusion:

Based on findings of the current study, it can be concluded that; nearly more than two

thirds of the studied nurses had good knowledge and most of them had incompetent practices regarding heel stick puncture and pain management of the neonates. Also the majority of the studied nurses had positive attitude regarding pain management of neonates undergoing heel stick puncture, and there were statistical significant relation between non-pharmacological pain methods and level of pain of the neonates.

Recommendations:

Based on the findings of the current study the following recommendations are suggested:

1. Periodic assessment of nurse's performances regarding pain management of neonates undergoing heel stick puncture.
2. Encourage neonatal nurses to update their knowledge and practices through attending training program, workshop about non-pharmacological pain methods of the neonates undergoing heel stick puncture.
3. Raising awareness of neonatal nurses about swaddling, nesting, massage, kangaroo care, and sucrose administration as a non-pharmacological pain management method for the neonates.
4. Designing an illustrated booklet containing non pharmacological pain management methods for neonates and NICU during heel stick puncturer.
5. Establish strategies for nurses regarding using appropriate non-pharmacological intervention to minimize the pain of neonates undergoing heel stick puncture.
6. More attention must be paid to assess, control and manage neonatal pain through non pharmacological intervention for nurses in NICU during heel stick puncture.
7. Integrate non pharmacological pain intervention for neonatal pain during heel stick puncture in nursing curriculum.

References:

Adam, N., Dabash, B. S., Hassan E., & Daihoum, T. E. (2020). Nurses' Perception about Pain Assessment and Management in Neonatal Intensive Care Units Department of Pediatric Nursing, Faculty of Nursing, Departments of Pediatric Nursing, Neonatology, Faculty of Medicine, Cairo University, Cairo, Egypt. Egyptian Nursing Journal, 16(3), 175-288.

Alburaey, A. M., Al-Qurashi F. O., Aljohar A. Y., Almubayedh K. A., Ahmed N. A., Alabdullatif H. A., & Alowayshiq H. M. (2020): Pain Assessment and Management in Neonatal Intensive Care Units in the Eastern Province of Saudi Arabia: A Survey of Doctors and Nurses. Saudi J Med Med Sci. 2020 May-Aug; 8(2):140-145. doi: 10.4103/sjmms.sjmms_7_19. Epub 2020 Apr 17. PMID: 32587496; PMCID: PMC7305675.

Alebel, A., Wagnew, F., Petrucka, P., Tesema, C., Moges, N. A., Ketema, D. B., ... & Kibret, G. D. (2020). Neonatal Mortality in the Neonatal Intensive Care Unit of Debre Markos Referral Hospital, Northwest Ethiopia: a Prospective Cohort Study. BMC Pediatrics, 20(1), 1-11.

Anand, K. J., Eriksson, M., Boyle, E. M., Avila-Alvarez, A., Andersen, R. D., Sarafidis, K., & Europain Survey Working Group of the Neoopioid Consortium. (2017). Assessment of Continuous Pain in Newborns Admitted to NICU in 18 European Countries. Acta Paediatrica, 106(8), 1248-1259.

Aydin, D., & İnal, S. (2019). Effects of Breastfeeding and Heel Warming on Pain Levels during Heel Stick in Neonates Faculty of Health Sciences, Department of Pediatric Nursing, Bandirma Onyedi Eylul University, Bandirma, Turkey Health Sciences, 25(3). 10200.

Ayede, A. I. (2020). Neonatal Pain Management in Sub-Saharan Africa. The Lancet Child & Adolescent Health, 4(10),713-714.

Chen, Y., Tong, Y., Xue, Z., Cheng, Y., & Li, X. (2020). Evaluation of The Reliability and Validity of the Behavioral Indicators of Infant Pain Scale in Chinese Neonates. Pain Management Nursing, 21(5), 456-461.

De Clifford Faugère G., Aita M., Feeley N., Colson S. (2022). Nurses' Perception of Preterm Infants' Pain and the Factors of Their Pain Assessment and Management. J Perinat Neonatal Nurs. Jul-Sep 01; 36(3):312-326.

Forest, S., & Harris-Haman, P. A. (2022). Development and Implementation of a Neonatal Pain Management Guideline for Minor Surgeries. Advances in Neonatal Care, 22(5), 391-399.

Forest, S., & Harris-Haman, P. A. (2022). Development and Implementation of a Neonatal Pain Management Guideline for Minor Surgeries. Advances in Neonatal Care, 22(5), 391-399.

Franck, L. S., Waddington, C., & O'Brien, K. (2020). Family integrated care for preterm infants. *Critical Care Nursing Clinics*, 32(2), 149-165.

Goto, T., Inoue, T., Kamiya, C., Kawabe, H., Higuchi, M., Suyama, M., & Yamada, Y. (2020): Neonatal Pain Response to Automatic Lancet Versus Needle Heel-Prick Blood Sampling: A Prospective Randomized Controlled Clinical Trial. Pediatrics International, 62(3), 357-362.

Mohamed, F., El-Bana, S., Mohamed, E., & Abolwafa, N. (2018): Effect of Educational Program on Pediatric Nurses' Knowledge and Practice regarding Selected Nonpharmacological Techniques to Relive Pain in Neonates. Minia Scientific Nursing Journal, 003(1), 55-63. doi: 10.21608/msnj.2018.187732.

Napiorkowska-Orkisz M., Gutysz-Wojnicka A., Tanajewska M., Sadowska-Krawczenko I. (2022): Evaluation of Methods to Minimize Pain in Newborns during Capillary Blood Sampling for Screening: A Randomized Clinical Trial. Int J Environ Res Public Health. 2022 Jan 13; 19(2): 870. doi: 10.3390/ijerph19020870. PMID: 35055694; PMCID: PMC8775482.

Nimbalkar, S., Shukla, V.V., Chauhan, V., Phatak, A., Patel, D., Chapla, A., & Nimbalkar, A. (2020): Blinded Randomized Crossover Trial: Skin-to-skin Care VS. Sucrose for Preterm Neonatal Pain. Journal of Perinatology, 40(6), 896-901.

Shayani, L. A., & Marães, V. R. F. D. S. (2022): Manual and Alternative Therapies as Non-Pharmacological Interventions for Pain and Stress Control in Newborns: a Systematic Review. World Journal of Pediatrics, 1-13.

Yilmaz, D., & Inal, S. (2020): Effects of Three Different Methods Used During Heel Lance Procedures on Pain Level in Term Neonates. Japan Journal of Nursing Science, 17(4), 11-13.

Zeng, Zi, Duan, Yan-Xia and Song, Guo-Min. (2020): "Non-Pharmaceutical Intervention and Pain Management Situation for Neonatal Analgesia" Frontiers of Nursing, vol.7, no.4, 2020, pp.299-305. https://doi.org/10.2478/fon-2020-0039

Zhang Y., Deng Q., Zhu B, Li Q., Wang F., Wang H., Xu X., & Johnston L. (2018): Neonatal Intensive Care Nurses' Knowledge and Beliefs regarding Kangaroo Care in China: a National Survey. BMJ Open. 2018 Aug 30; 8(8): e021740. doi: 10.1136/bmjopen-2018-021740. PMID: 30166300; PMCID: PMC61*19424.*