

Effect of Implementing Educational Program about Care for Neonates Undergoing Umbilical Venous Catheter Installation on Nurses Performance
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Abstract

Background: Umbilical venous catheter (UVC) is very easy and quick method of gaining access to deep vein in comparison to cannulation. **Aim:** The research aim was to evaluate the effect of implementing educational program about care for neonates undergoing UVC installation on nurses' performance. **Design:** A quasi-experimental research design was utilized; the research was conducted at neonatal intensive care unit (NICU) El-Mahalla General Hospital. **Subjects and Method:** A convenience sampling of sixty nurses who were working at above mentioned setting and forty neonates who were admitted at NICUs within a period of six months whose umbilical cord were still connected to circulatory system and both sexes. **Tools of data collection: Tool (I): Structured interview schedule:** It includes a: Socio demographic characteristic of nurses b- Neonates' characteristics and Nurses knowledge about care of neonates undergoing UVC installation. **Tool (II) An observational Check list to assess nurses' practice. Results:** There were a positive correlation between nurses' knowledge and their practices before, immediately after program implementation and one month after program implementation regarding care of neonates undergoing UVC installation. **Conclusion:** Nurses' knowledge and practice were improved after implementing the program. **Recommendation:** The pediatric nurse should be taught the basic clinical skills regarding care of UVC periodically and regularly through applying a training program.

Key words: Educational Program, NICU, Nurses Performance, Umbilical Venous Catheter Installation.

Introduction

The fetal cord contains just one vein and two arteries; umbilical venous catheterization is an essential procedure in neonatal critical care units. The umbilical vein is roughly 2-3 cm in length and 4-5 mm in diameter, and it connects the placenta to the fetus, delivering oxygenated blood. After splitting into many intrahepatic branches at the umbilicus, the left portal vein eventually connects to it and then continues on to the inferior vena cava

through a channel known as the ducts venous. ⁽¹⁾

The umbilical arteries are a direct extension of the internal iliac arteries and go inferiorly and then dorsally as they pass the bladder and curve medially to reach the aorta, delivering deoxygenated blood from the fetus to the placenta. ⁽²⁾

The umbilical vein or artery, can be used but the preferred one at NICUs is the umbilical venous catheter (UVC), it is useful for rapid vascular access, accurate laboratory

determination, and providing fluids, medications, blood and parenteral nutrition. The UVC should not go beyond over 5 days, however it is allowed for no over 14 days.^(3,4) Infection at this site, poor blood flow to the intestines, compromised blood flow to the legs or buttocks, a history of bruising, bleeding, or clotting, or vascular anomalies are contraindications for using UVC, on the other side exomphalus, exomphalitis, necrotizing enterocolitis are considered absolute contraindication^(5,6).

There are dangerous complications that may cause death as bleeding, thrombosis and infection. This risk can be reduced through removal of the line after 7 days, or at most 14 days, or when it is not needed. Cardiac tamponade rarely occurs due to wrong position of UVC^(7,8).

Inadvertently piercing the hepatic capsular membrane might cause harm to the newborn's liver. A newborn may show symptoms of cardiac arrest, abdominal distention, or anemia for no apparent reason. While an abdominal ultrasound may help detect this condition, the only treatment option is symptomatic care, including correction of anemia and coagulopathy. Also, hyperosmolar solution infusion via an incorrectly positioned catheter might cause hepatic parenchymal damage. Parenchymal necrosis or ascites caused by infusate extravasation. When the catheter is taken out, the therapy is complete.^(9,10)

Nurse have an important role in caring of UVC as looking for bleeding, manifestations of infection as hyperthermia, rapid heart rate increased white blood cells count, decreased platelets, positive blood cultures. Other signs may be observed due to sepsis as poor handling, desaturation, bradycardia or apnea. The nurse should record all nursing care and signs observed in nursing notes to maintain

continuity of care and to preserve accountability.⁽¹¹⁾

Significance of the research

Neonatal period is the most susceptible time for a child's survival. Worldwide, around 2.6 million children loss their life during neonatal period, approximately 7,000 newborns dying every day, most of this occurs during first week of life.⁽¹²⁾

Preterm newborns weighing less 2.5kg or possess a health condition that needs special care must enter NICU. Up to 80% of preterm newborns whose weight is under 1,500 g receive medications, fluids, and nutrition via such catheters.^(13,14) Pediatric nurse, who take care of neonates, should possess a major role in the healthcare team carrying out UVC procedure; this will improve outcomes for neonates.⁽¹⁰⁾

Goal of the research

The purpose of this research was to see if nurses' performance improved after receiving training on how to care for newborns with an UVC inserted.

Research Hypothesis

Nurses' performance was expected to be improved after implementation of an educational program about care provided for neonates undergoing UVC installation.

Subjects and method

Research design: a quasi-experimental research design was used.

Setting: The research was done at NICUs of El-Mahalla General Hospital which is affiliated to Ministry of Health and Population.

Subjects:

- Convenience sampling of 60 nurses from above mentioned setting who were working at neonates' intensive care units and took care of neonates undergoing UVC installation.

- Forty neonates who were admitted at NICUs within a period of six months whose umbilical cord was still connected to circulatory system and both sexes.

Tools of collecting data:

- **Information was gathered via two sources:**

Tool (I): The following is a sample timetable for a structured interview: Developed by the researcher following a thorough evaluation of the relevant literatures ^(2,3), it included two sections.

Part (1) a- focuses on the nurse's socio-demographics, including their age, education, place of residence, number of years in the field, and attendance at UVC-related training courses.

b- Neonates characteristics as: Age, sex, gestational age, birth weight and diagnosis.

Part (II):- Nurses knowledge about care of neonates undergoing umbilical venous catheter (UVC) installation such as definition, indications, contraindications, method of estimating the length of inserted UVC, proper insertion, site for UVC, the care required before, during and after insertion of UVC, and nursing role in prevention and management of UVC complications.

Scoring system for nurses' knowledge was as following: -

- Correct and complete answer was scored (2).
- Correct and incomplete answer was scored (1).
- Don't know was scored (0).

Total scoring system for nurses'knowledge was categorized as the following: -

- From 80 % and more was considered high level of **knowledge**.
- From 60 to under 80% was considered moderate level of **knowledge**

- Under 60% was considered low level of **knowledge**

Tool (II):- Nurse practice about care of neonates undergoing umbilical venous catheter by observational Check list:

It was adapted and modified by the researcher to assess nurses' practice about care for neonates undergoing UVC. It was used three times before, immediately and one month after implementation of care as the following.

1- **Before UVC installation:** - Hand washing, preparation of equipment, assessment of neonates' umbilical cord.

2- **During UVC installation:** -Umbilical catheter technique and fixation of catheter.

3-**After UVC insertion:**

a- Removal of contaminated items, catheter dressing, documentation and hand washing

b- Technique of blood sampling from UVC

c- Ongoing care for umbilical catheter: - Daily care of UVC and after administration of blood or blood products.

d- Removal of UVC: -Technique of removal and precautions immediately after its removal.

Scoring system for nurse practice was scored as following: -

- Done correct and complete was scored (1).
- Not done was scored (0).

The total scoring system for nurses' practice was calculated as following: -

- Under 80 % was considered unsatisfactory.
- From 80 % to 100% was considered satisfactory.

Method

The research was accomplished through the following steps:

1-Administrative process:

- The researcher got an official permission from Faculty of Nursing, Tanta University

and was submitted to responsible authorities of the selected settings for permission to facilitate performance of the research.

2- Legal and ethical considerations:

a. An approval from the research ethics committee from Faculty of Nursing at Tanta University.

b. The research volunteers were not harmed in any way, and they had no discomfort.

c. Privacy and security were considered throughout data collecting.

d. The research aim was explained to the nurses before they gave their agreement to participate.

e- The nurses had the right to withdraw

3-Tool development:

Tools of the research were developed by the researcher after reviewing recent related literature (2,3).

4- A jury of five neonatal nursing professionals was provided with the tools of the research to evaluate the validity of the contents and the clarity of the questionnaire. Adjustments have been made accordingly. After determining the index of validity of the item content, the nominal validity of the questionnaire was calculated on the basis of expert opinion and was 99.1%.

5-The reliability of Content:

The research tools were tested by the pilot subjects. The test of reliability by using (cronbach's alpha) coefficient which was (0.891) for Education and (0.781) which indicates that data collection tools had good level of internal consistency.

6- A pilot research:

Ten percent of the nurses participated in pilot research to examine the research capability of clear and useful results. The study's sample did not include pilot sample.

7- **Interview schedule** was translated into Arabic language by the researcher (Tool I)

8-Phases of the research

The present research was conducted at four phases of educational program including assessment, planning, implementation and evaluation.

1) Assessment phase:

The researcher conducted meeting with nurses, who participated in the research in order to explain the purpose aim of the research, collect data about nurse and neonates and to assess nurse knowledge and practice about care provided to neonates at NICUs before implementing an educational program.

2) Planning phase:

Based on the results of a requirements analysis and a study of relevant literature, a training curriculum for nurses was developed which included the following:

a- Setting specific objectives of the educational program.

b- Preparation of the content of educational program.

c- Different methods and materials for educational program were used including lecture, demonstration and re-demonstration, video tape, power point and poster presentation for educating nurse.

3) Implementation phase:

-The researcher interviewed with the available nurse at NICU and the aim of research was explained and their approval was obtained to participate in the research prior to data collection.

-The nurses' performance level was assessed related to care of neonates undergoing UVC (pre-nursing interventions implementation) by using nurse structured interviewing sheet and by using observational checklist as following the first tool was administered to all nurse at NICUs.

- The second tool was used to observe every nurse throughout UVC installation procedure

from initiation to termination using concealed continuing observation.

- All nurses were observed in the morning and afternoon shifts. As part of their regular duties, nurses participated in educational courses and received on-the-spot training.

-Eight sessions were conducted for nurses. (3 sessions for knowledge and 5 sessions for practice), these sessions were repeated when required. The duration of each session was about 30- 45 minutes, included 15 minutes for discussion and feedback.

- The goals of the new topic were introduced at the start of each session. Different teaching techniques, including lectures and group discussions, as well as different teaching tools, including data displays and PowerPoint presentations, were employed. Feedback and reinforcement of designed nursing interventions were done.

- Nurses were divided into six subgroups each subgroup consisted of 10 nurse were educated two days per week.Each session rangiest from 30- 45 minutes.

The content of the session included:

First session: Focused on definition, types, causes, indications, contraindications, and complications of UVC insertion.

Second session: Method of estimating the length of inserted UVC installation, site for UVC, changes between umbilical vein and umbilical arteries.

Third session: Prevention and management of UVC complications.

Fourth session: Nursing intervention before installation of UVC.

Fifth session: Nursing intervention during installation of UVC.

Sixth session: Nursing intervention after installation of UVC.

Seventh session: Blood sampling procedure from the UVC.

Eighth session: It included ongoing care of UVC, removal of UVC procedure.

-The data was collected over a period of six months (from November 2021 to April 2022).

4) Evaluation phase:

The nurses were observed by the researcher for the care provided to neonatal umbilical catheter pre-program and then post-program. The nurses were evaluated before, immediately and one month after implementation of the educational program to assess their performance about care of neonates undergoing UVC installation by using (**Tool I and II**).

Statistical analysis:

Descriptive statistics, such as frequencies and percentages for categorical variables, were calculated from the obtained data using statistical package for the social sciences (SPSS 22.0). For continuous variables, we calculated means and standard deviations. The degree of association between the research variables was calculated using the Pearson correlation coefficient. Relationships between research variables were predicted using regression analysis. Categorical variables were correlated using chi square testing ⁽¹⁵⁾

Results

Table (1): Demonstrates socio-demographic characteristics of studied nurses. It was observed that all nurses were females (100%) and nearly half of them were between 25 to under 30 years old with Mean±SD of age (29.52±4.16). About three quarters of them (73.3%) hold bachelor degree in nursing science. Regarding nurses' experience at the NICU, about half of them (43.3%) had 5 and more years of experience. Concerning previous training about umbilical catheter care, over three quarters of

them (76.7%) did not attend any training courses related to UVC care.

Table (2): Shows bio-socio-demographic characteristics of neonates, it was found that over half of them (60%) were females, and nearly half of them (47.5%) were under 4 days of age with Mean \pm SD age (8.18 \pm 4.31) days. It was clear that, nearly majority of them (92.5%) their gestational age was 28 week and more with mean \pm SD (34.32 \pm 3.40). Also, half of them (50%) were about 2 to less than 3 kg with Mean \pm SD of birth weight was (2.59 \pm 1.05). Regarding their diagnosis, three quarters of them (75%) had respiratory distress syndrome.

Table (3): Shows percentage distribution of total knowledge levels of nurses about care of neonates undergoing umbilical venous catheter installation through program phases. The table presents that almost all nurses show high levels of knowledge immediately after and after one month of program implementation (100% and 96.7% respectively) compared to before program implementation where more than half of them (56.7%) had high levels, moderate and low levels (28.3%, 15%) respectively. There were statistically significant differences regarding levels of nurses' knowledge between before and immediately after.

Table (4): displays the percentage distribution of the practice levels of nurses through program phases. Nearly all studied nurses had satisfactory practice levels immediately after and one month after program implementation (100% and 96.7% respectively) compared to only 78.3% who had satisfactory levels before program implementation.

These changes in practice levels through program phases were statistically significant in nurse practice before installation of catheter, during installation, after installation

in blood sampling, ongoing care, except removal of catheter there was only statistically significant change between immediately after and after one month. As illustrated in **figure (1)**.

Table (5): Shows correlation between nurses' knowledge and practices about care of neonates undergoing UVC installation through program phases. There were a positive correlation between nurses knowledge and their practices before program ($r=0.377$, $p=0.003$), immediately after program implementation ($r=0.423$, $p=0.001$) and one month after program implementation ($r=0.531$, $p=0.000$).

Table (1): Percentage distribution of studied nurse according to socio-demographic characteristics (n=60).

Socio-demographic characteristics of nurse	No	%
Gender		
Male	0	0.00
Female	60	100
Age		
Under 25	11	18.3
25>30	27	45
30>35	16	26.7
35>40	6	10
Mean±SD	29.52±4.16	
Education		
Nursing technical institute	10	16.7
Bachelor of nursing	44	73.3
Graduate Studies	6	10
Years of Experience		
Less 1 year	9	15
1>3	11	18.3
3>5	14	23.3
5years and more	26	43.4
Mean ±SD	5.75±2.65	
Previous training courses related to UVC care.		
Yes	14	23.3
No	46	76.7

Table (2): Percentage distribution regarding neonates bio- socio-demographic characteristics (n=40).

Bio-socio-demographic characteristics of neonates	No	%
Gender		
Male	16	40
Female	24	60
Neonate age (days)		
Under 4	19	47.5
4>8	7	17.5
8>12	5	12.5
12 and more	9	22.5
Mean ±SD	8.18±4.31	
Gestational age (Weeks)		
Under 28	3	7.5
28 and more	37	92.5
Mean ±SD	34.32±3.40	
Birth weight (Kg)		
Under 2	9	22.5
2>3	20	50
3 and more	11	27.5
Mean ±SD	2.59±1.05	
Diagnosis		
Respiratory Distress Syndrome(I,II,III,IV)	30	75
Jaundice (ABO,RH incompatibility, physiological)	6	15
Congenital Anomalies(Hydrocephalus, Cleft lip and palate ,Intestinal obstruction)	3	7.5
Infant of Diabetic Mother	1	2.5

Table (3): Percentage distribution of total knowledge levels of studied nurses about care of neonates undergoing umbilical venous catheter installation (n=60).

knowledge levels	Before (n=60)		Immediately after (n=60)		After 1 month (n=60)		χ^2 (P)	(P ₁)	(P ₂)	(P ₃)
	No	%	No	%	No	%				
High	34	56.7	60	100	58	96.7	53.526 (0.000**)	33.191 (0.000**)	27.103 (0.000**)	2.034 (0.154)
Moderate	17	28.3	0	0.00	2	3.3				
Low	9	15	0	0.00	0	0.00				

(<60%) Low

(60-<80) % Moderate

(≥80 %) High

* Significant difference at P< 0.05

** Significant difference at P< 0.01

P₁=between before and immediately after,P₂=between before and after 1 month,P₃=between immediately after and after 1 month.

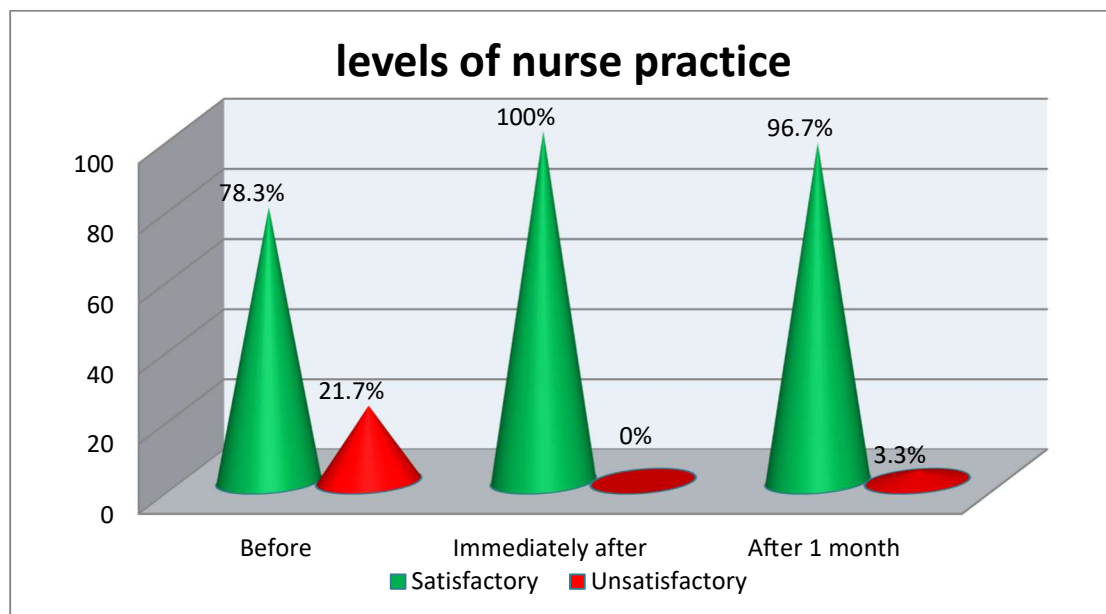


Figure (1): Nurse practice through program phases (n=60)

Table (4): Percentage distribution of the practice levels of nurse through program phases (n=60).

Nurse Practice	Before (n=60)				Immediately after (n=60)				After 1 month (n=60)				χ^2 (P)	χ^2 (P ₁)	χ^2 (P ₂)	χ^2 (P ₃)
	Satisfactor y		Unsatisfactor y		Satisfactor y		Unsatisfactor y		Satisfactor y		Unsatisfactor y					
	No	%	No	%	No	%	No	%	No	%	No	%				
Before	56	93.3	4	6.7	60	100	0	0.0	60	100	0	0.0	8.182 (0.017*)	4.138 (0.042*)	4.138 (0.042*)	-
During	21	35	39	65	56	93.3	4	6.7	48	80	12	20	52.853 (0.000**)	44.397 (0.000**)	24.859 (0.000**)	4.615 (0.032*)
After	52	86.7	8	13.3	60	100	0	0.0	59	98.3	1	1.7	13.333 (0.001**)	8.571 (0.003**)	5.889 (0.015*)	1.008 (0.315)
Sampling	46	76.7	14	23.3	60	100	0	0.0	57	95	3	5	21.176 (0.000**)	15.849 (0.000**)	8.292 (0.004**)	3.077 (0.079)
Ongoing care	25	41.7	35	58.3	60	100	0	0.0	57	95	3	5	75.332 (0.000**)	49.412 (0.000**)	39.435 (0.000**)	3.077 (0.079)
Removal	58	96.7	2	3.3	60	100	0	0.0	56	93.3	4	6.7	4.138 (0.126)	2.034 (0.154)	0.702 (0.402)	4.138 (0.042*)
Total	47	78.3	13	21.7	60	100	0	0.0	58	96.7	2	3.3	21.382 (0.000**)	14.579 (0.000**)	9.219 (0.002**)	2.034 (0.154)

* Statically significant change at P< 0.05

** Significant change at P< 0.01

Table (5): Correlation between nurses' knowledge and practices about care of neonates undergoing umbilical venous catheter installation through program phases (n=60).

Correlation	Total Knowledge					
	Before program		Immediately after		After 1 month	
	R	P-value	R	P-value	R	P-value
Total Practice	0.377	0.003**	0.423	0.001**	0.531	0.000**

* Significant change at $P < 0.05$ ** Significant change at $P < 0.01$

** . Correlation is highly significant at the 0.01 level.

Discussion

In the treatment of critically unwell newborns, the use UVC has become common place. Umbilical catheters, both arterial and venous, are an essential part of therapy because they offer a consistent route for administering fluids and medications, monitoring vascular pressure, and routine blood drawing. Despite being widely used, UVCs do occasionally cause difficulties. Therefore, neonatal nurse need to be aware of and keep a close eye out for any linked issues. ⁽¹⁴⁾

Concerning the studied nurses' gender, the current research revealed that all studied nurses were females. On the same line, **Kandil, et al (2021)** conducted a research and reported that most of studied nurse were female ⁽¹⁶⁾. Also the current research was in congruence with **Abou Zed and Mohammed (2020)** who conducted a research and reported that all studied nurse were female. ⁽¹⁷⁾

The research revealed that, most of studied nurse in the current research were between 25 and 30 years old with mean age 29.52 years. The current research was in agreement with **Kandil et al, (2020)** who reported that over one third of nurse aged from 25 to under 30 years old and their mean age was 27.29 years. ⁽¹⁶⁾On the other

hand, **Ismail &mostafa., et al (2016)** reported that that most of studied nurse their ages were ranging from 20 to 30 years. ⁽¹⁸⁾

Most of nurse in the current research had bachelor degree in nursing science. The finding of the current research was congruent with **El bilgahy et al. (2016)**, who stated that three-quarters of studied nurse had a bachelor in nursing science. ⁽¹⁹⁾ The finding of the current research was incongruent with **Abou Zed and Mohammed (2020)** who found that most of studied nurse had in secondary school education. ⁽¹⁷⁾

The current research cleared that, most of studied nurse had experience of 5 years and more in neonatal ICU. The finding of the current research was congruent with **El bilgahy et al. (2016)**, who stated that approximately two-thirds of studied nurse having over 5 years of experience. ⁽¹⁹⁾

Concerning training about umbilical catheter care, most of studied nurses in the current research did not have any training courses about UVC insertion and care. From the researcher point of view this might be due to shortage of the staff which keeps them had no time to attend any training program. This finding of current research was inconsistent with **Manzo et**

al., (2019) who conducted research and reported that, most of nurse had received training program about UVC infection &nursing care bundle.⁽²⁰⁾

Concerning the gender of studied neonates, the current research revealed that most of them were female. This result agreed with **Bannatyne et al., (2018)** who stated that, most of neonates were female.⁽²¹⁾ On the contrary, **Dongara et al., (2017)** reported that nearly three quarters of studied neonates were male.⁽²²⁾

Concerning the neonates' age, most of neonates in the current research were aged under one month. On the other hand, **Kandil et al, (2020)** illustrated that over one third of studied neonates aged 1>5 days and the mean age was 2.64days.⁽¹⁶⁾ Concerning the gestational age, most of studied neonates in the current research had 28 weeks and more. The current research was in consistence with **Kandil et al, (2020)** who found that their mean gestational age was 32.29weeks, and over two-thirds of them were born before 37 weeks⁽¹⁶⁾.

Concerning birth weight, most of studied neonates in the current research had birth weight between two and three kilograms. The mean weight of neonate was 2.59. This finding was incongruent with the research of **Dongara, et al., (2017)** who declared that mean weight of neonates was 2.139 kilograms.⁽²²⁾

Concerning diagnosis, most of studied neonates in the current research had respiratory distress syndrome (RDS). The current research was in the same line with **Ahmed et al., (2015)** who found that most of studied neonates had respiratory distress syndrome.⁽²³⁾

Concerning nurses' knowledge about care for neonates undergoing UVC installation.

The overall mean score of nurses' knowledge through program phases immediately after and after one month of program implementation was higher compared to before program scores which indicated improvement in nurse overall mean score of knowledge about care of neonates undergoing UVC installation. From the researcher's point of view, the improvement in nurse education could be attributed to the effect of the educational program. The current research was in agreement with **Nowail, et al., (2016)** who conducted research and mentioned that there was significant improvement in nurse knowledge post- program implementation as compared to pre-program.⁽²⁴⁾

Concerning nurses' practice about care of neonates undergoing UVC through program phases. The percentages of practice items before UVC installation done immediately after and one month after the program implementation were higher compared to before program implementation which indicating an improvement in nurse practice. From the researcher's point of view, this improvement in nurse practice could be attributed to the effect of educational program regarding care provide to neonates either before, during and after catheter installation.

Also the finding of the current research was in congruence with **Shahid et al, (2014)** who implemented guidelines standardizing the use of UVC in NICU and found that fewer infants were exposed to the risks of UVC.⁽²⁵⁾

The research also clarified that there were significant statistical positive significant correlations between nurses' knowledge and their practices before program, shortly after implementing the program and again

one month later. The researcher hypothesizes that the current findings may be attributable to the nurses' knowledge that works as a significant and separate component in the implementation of UVC procedures.

The current research was in agreement with **Kandil et al, (2020)** who reported that there was positive correlation between total education of studied nurse and their total practice at pre- and post-program implementation. ⁽¹⁶⁾

Conclusion

It may be inferred from the present study that: Nurses' performance regarding the care of newborns having UVC placement have improved. Before, during, and after the first month of the program's implementation, there was a highly significant positive association between nurses' knowledge and practice.

Recommendations

- 1 Periodically and routinely, in-service training program should be held to teach nurses the fundamental clinical abilities related to umbilical venous catheter care and how to avoid complications.
- 2 To encourage nurses to participate in the educational program that need to be conducted at work, a system for accreditation and certification should be devised.
- 3- Developing a system at intensive care units for evaluating working nurse education and practice regarding updated strategies in care of neonates undergoing umbilical venous catheter instillation.

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