Performance of Nurses Caring for Neonates with Persistent Pulmonary Hypertension

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Abstract

Background: Persistent pulmonary hypertension of the newborn (PPHN) is a syndrome of failed circulatory adaptation at birth due to delay or impairment in the normal fall in pulmonary vascular resistance (PVR) that occurs after birth. **Aim of the study:** To assess performance of nurses caring for neonates with PPHN. **Design:** A descriptive design was used in this study. **Settings:** This study was carried out in neonatal intensive care units at Children's Hospital and Obestatric Gynacological Hospital affiliated to Ain Shams University and Fayoum General Hospital affiliated Ministry of Health in Fayoum Governorate. **Subjects:** A convenient sample of all available staff nurses (100) and working in the previously mentioned settings. A Purposive sample of neonates with inclusion criteria: Neonates with gestational age more than 37 weeks of gestation and their birth weight more than 2500 gm, and exclusion criteria: Neonates with congenital anomalies and neonates with other chronic disorders. **Data collection**: Three tools were used in this study as follows, 1. Predesigned questionnaire, 2. Observational checklist and 3. Attitude rating scale. **Results:** Findings revealed that high statistically significant relation, positive correlation between total knowledge with total attitude and positive correlation between total knowledge with total practice, total attitude and total practice. **Conclusion:** More than half of studied nurses had good knowledge about PPHN, three quarters of studied nurses had competent practice during caring for neonates with PPHN, and the majority of them had positive attitude regarding caring for neonates with PPHN. **Recommendations:** Increasing staff nurses knowledge through educational program and training courses.

Keywords Persistent Pulmonary Hypertension, Meconium Aspiration Syndrome, Pulmonary Vascular Resistance, Neonatal Intensive Care Units, Neonates, Performance of Nurses.

Introduction

Persistent Pulmonary Hypertension of Newborn (PPHN) is a life-threatening condition, most common event in the neonatal intensive care unit, and affects both term and preterm neonates. PPHN is one of the main causes of neonatal morbidity and mortality. It is characterized by sustained elevation of Pulmonary Vascular Resistance (PVR), preventing an increase in pulmonary blood flow after birth. The affected neonates fail to establish blood oxygenation, precipitating severe respiratory distress, hypoxemia, and eventually death ***(Lloyd & Smith, 2016).***

In addition, PPHN is a serious neonatal condition, which associated with high mortality and morbidity. It results from failure of the neonate to make a postnatal transition from a high resistance fetal pulmonary circulatory state to a low resistance pulmonary circulation. This increased pulmonary vascular resistance and decreased pulmonary blood flow prevents adequate gas exchange in the lungs resulting in severe respiratory distress and hypoxemia in the neonate ***(Fraser, 2020).***

Successful adaptation to extrauterine life requires a rapid increase in pulmonary blood flow at birth to establish the lungs as the site of gas exchange. Additionally, PPHN is secondary to failure of normal circulatory transition at

birth. It is a syndrome characterized by elevated PVR that causes labile hypoxemia due to decreased pulmonary blood flow and right-to-left shunting of blood ***(Martinho et al., 2020).***

Pathophysiologic mechanisms responsible for PPHN can be classified into maladaptation, maldevelopment, underdevelopment and intrinsic obstruction. Maladaptation occurred through excessive secretion and action of vasoactive mediators, as in sepsis, Meconium Aspiration Syndrome (MAS), pneumonia, and asphyxia, is responsible for majority of the cases of PPHN. Maldevelopment is associated with chronic fetal hypoxia, fetal anemia, or intrauterine closure of ductus arteriosus from maternal medications as non steroidal anti-inflammatory drugs NSAIDs ***(Weisz & McNamara, 2016).***

Idiopathic PPHN also results from maldevelopment. Pulmonary hypoplasia with underdevelopment of pulmonary vasculature originates mostly from congenital diaphragmatic hernia or oligohydramnios from any cause. High viscosity resulting in intravascular obstruction of pulmonary arteries Polycythaemia, e.g. Infant of Diabetic Mother (IDM) ***(Sardar et al., 2020).***

Diagnosis of PPHN is based on clinical evidence of labile hypoxemia often associated with differential cyanosis, confirmed by echocardiography, pre ductal and post ductal oxygen saturation, Pre-ductal saturation 5-10% higher than post-ductal, chest x-ray to identify underlying parenchymal disease, complete blood count to diagnose infection and/or polycythaemia, serum glucose ad calcium to underlying metabolic causes ***(Lesneski et al., 2020).***

Main goals of treatment of PPHN are to decrease pulmonary vascular resistance, increase pulmonary blood flow and prevent hypoxia, Lung volume recruitment with optimal use of positive end-expiratory pressure or mean airway pressure and/or surfactant is very important in secondary PPHN due to parenchymal lung disease. This is carried out by correcting the underlying disease, good supportive care, and selective pulmonary vasodilators such as inhaled nitric oxide (iNO), Magnesium sulphate ($MgSO_4$) and Oral sildenafil ***(Chawla 2021).***

Other management strategies include optimal oxygenation, avoiding respiratory and metabolic acidosis, blood pressure stabilization, sedation, and pulmonary vasodilator therapy. Failure of these measures leads to consideration of extracorporeal membrane oxygenation, although this rescue therapy is needed less frequently with advances in medical management. Randomized clinical trials with long-term follow-up are required to evaluate various therapeutic strategies in PPHN ***(Rawat et al., 2020).***

Nurses' performance, especially, in the NICU, is permeated by a complex and specialized care, by new implementations in attendance. In addition to technical skill, it is valued a humanized therapeutic care, which involves tasks relating to the individuality of care, stimulation by the presence of parents, encouragement of affective bonding and caring touch, reduction of external stimulus (sound, noise, light, and temperature). These interventions are relevant, in an attempt to reduce excessive handlings, since they can cause pain, discomfort, and physiological changes, which compromises the welfare of the newborn ***(Gijtenbeek et al., 2017).***

Aim of the study:

This study aimed to assess performance of nurses caring for neonates with persistent pulmonary hypertension.

Research Questions:

The current study answered the following question:

What is nurses' knowledge level regarding care of neonates with PPHN?

What is nurses' practice level regarding care of neonates with PPHN?

What is nurses' attitude regarding care of neonates with PPHN?

Subjects and Methods

Technical design:

The technical design includes research design, research setting, subjects of the study and tools for data collection.

Research design:

A descriptive study was utilized in this study

Research Settings:

This study was conducted at the Neonatal Intensive Care Unit (NICU) at Children's Hospital and Obestatric & Gynacological Hospital affiliated to Ain Shams University in Cairo and Fayoum General Hospital affiliated Ministry of Health in Fayoum Governorate.

Subjects of the study:

A convenient sample was included all nurses available (100) nurses at the NICU of the mentioned settings (15) nurses from Children's Hospital, (20) nurses from Obestatric & Gynacological Hospital and (65) nurses from Fayoum General hospital regardless their age, gender, qualification or experience and agree to participate in this study.

A Purposive sample of neonates with

Inclusions criteria:

1. Gestational age more than 37 weeks of gestation.
2. Birth weight more than 2500 gm.

Exclusions criteria:

1. Neonates with other chronic disorders
2. Neonates with congenital anomalies.

Tools for data Collection:

Three tools for data collection were used in the current study as the following:

Tool I: Pre-designed Questionnaire:

It was designed by the researchers after reviewing the related literature. It was written in Arabic language for collecting data including the following parts:

Part 1:

1. **Characteristics of nurses** such as: Age, gender, level of education and years of experience.
2. **Characteristics of neonates** such as: Gestational age, chronological age, gender, birth weight and diagnosis.

Part 2:

Nurses' knowledge related to caring for neonates suffered from PPHN at NICU such as: Definition, causes, signs and symptoms, diagnosis, management, complications and nursing care.

❖ **Scoring system**:

A scoring system was followed to assess nurses' knowledge regarding nursing care for neonates suffered from PPHN. The correct answer was scored as one point and the incorrect answer was scored as a zero point. The total score of the questionnaire was 29 grades. These scores were summed up and converted into a percentage scores.

Total scoring was classified into 3 categories: **Good** knowledge if score ≥75%, **Average** knowledge if score from 60 to less than 75%, **Poor** knowledge if score <60%.

Tool II: Nurses' practice Observational Checklist regarding caring for neonates with PPHN:

It was adapted from **Perry & Potter (2015), Lynn & Lebon (2013), Kenner & Lott (2016), Bowden & Greenberg (2016), Walsh (2016).)** To assess nurses' practices during caring for neonates suffered from PPHN, including: Checking pulse oximeter, intravenous cannulation, blood sampling, preparation and administration of high alert medication "dopamine and dobutamine", controlling environments of neonates noise and light level, minimal handling, monitoring blood pressure, suctioning, and care of oxygen therapy.

❖ **Scoring system**:

A scoring system of each checklist was assigned a score according to sub-items. The items was evaluated as "done" was taken one score and "not done" was taken zero score.

These scores were summed up and converted into a percentage score, and according total scoring was classified into 2 categories: **Competent** if score ≥ 80%, **Incompetent** if score <80%.

Tool III: Attitude Rating Scale:

Attitude rating scale was a questionnaire designed according to Likert like type rating scale to assess the attitudes of nurses during caring for neonates suffered from PPHN ***(Likert, 1932).***

The questionnaire consisted of 13 statements (9 positive and 4 negative). Each nurse was asked to respond to statements on a 3-point Likert Scale (agree, uncertain and disagree).

❖ **Scoring system:**

A scoring system followed each nurse's responses. Accordingly, statements of the scale was assessed and scored by 1 for "agree", 2 for "uncertain" and 3 for "disagree". Scores of the all the scale statements were summed up and total scoring was classified into 2 categories: **Positive** attitude if score ≥ 60%, **Negative** attitude if score < 60%.

Operational Design:

The operational design included preparatory phase, content validity, tool reliability, pilot study and field work.

The preparatory Phase:

It included reviewing of related literature and theoretical knowledge of various aspects of the study using books, articles, scientific journals, internet's periodicals and magazines to develop tools for data collection were developed and then translated into Arabic language.

Tool validity and reliability:

Validity of the developed tools was tested using face and content validity. Validity was tested through a panel of five experts from pediatric Nursing Department; 2 professors and 3 assistant professors from Faculty of Nursing, Ain Shams University to ensure tools' comprehensiveness, accuracy, clarity, understanding, applicability and relevance.

Tool reliability:

Reliability of the developed tool was tested to determine the extent to which the questionnaire items are related to each other. The *Cronbach's alpha* test which is a test used to measure internal consistency was used in the analysis (value throughout the assessment are 0.71 for total knowledge, 0.80 for total practice and 0.81for total attitude. Statistical equation of *Cronbach's alpha* reliability coefficient normally ranges between 0 and 1, higher value (more than 0.7) denote acceptable reliability.

Ethical considerations:

Approval of the study protocol was obtained from Ethical Committee in the Faculty of Nursing at Ain Shams University before starting the study. The researchers clarified the objective and aim of the study to the neonatal nurses included in the study. Maintaining anonymity and confidentiality of the subjects' data. Nurses were informed that they allowed choosing to participate or not in the study and that they have the right to withdraw from the study at any time without giving any reasons.

Pilot study:

A pilot study was carried out on 10% of nurses (10 nurses) from the study subjects to test the clarity, applicability, feasibility and relevance of the tools used, as well as to determine the needed time for the fill out of the study tools. The nurses who were included in the pilot study were included in the study subjects because No modification was done.

Field work:

The purpose of the study was simply explained to the nurses who agree to participate in the study prior to data collection. The actual work of this study started and completed within six months from the beginning of November (2019) to the end of April (2020). Data were collected by the researcher through two days per week (Saturday and Sunday), at morning and afternoon shifts in the previous mentioned setting. The observation checklist was completed by the researcher and it took 60

minutes for every nurse when providing the care for neonate. The time needed for completing the tools was about 30 minute by every nurse (20 minutes for knowledge &10 minutes for attitude). The nurses assured that the information collected would be treated confidentially and that it would be used only for the purpose of the study.

Administrative Design:

To carry out this study, the necessary approval was obtained from the hospital' director. A letter was issued to them from the faculty of nursing, ain Shams University explaining the purpose of the study to obtain the permission for conducting this study.

Statistical Design:

The collected data were organized, categorized, tabulated and statistically analyzed using the Statistical Package for Social Science (SPSS) version (20) to assess nurses' level of knowledge, practice and attitude regarding caring for neonates with PPHN.

Data were presented in tables and graphs. The statistical analysis included; percentage (%), the arithmetic mean ($\overline{X}$), Standard Deviation (SD), chi-square (X^2).

The observed differences and associations were considered as follows:

P > 0.05 non significance (No difference), P ≤ 0.05 significance difference, P < 0.001 highly significance difference.

Results:

Table (1): Regarding characteristics of studied nurses, Shows that more than half (55%) of the studied nurses their age ranged between 20 < 25 years old, with mean age **28.45±5.31**. The majority of studied nurses are females 86% and less than three quarter of them (72%) didn't have training courses about nursing care for PPHN.

Figure (1): As regards the studied nurses' educational qualification this figure shows that less than half (43%) of the studied nurses had health technical institute, more than one quarter (29%) of them had diploma of nursing, about one quarter (26%) of them had bachelor of nursing and only (2%) of them had post graduate studies.

Figure (2): As regards the studied nurses' years of experience, this figure demonstrate that, less than half (43%) of the studied nurses having years of experiences ranged from 1-< 5 years, while minority (8%) of them having years of experiences ranged from 10<15 years.

Table (2): Indicates that the majority of studied neonates (86%) **chronological age** from 1 to less than 10 days and, the most of studied neonates (95%) **gestational age** from 37 to 42 weeks, less than two third of studied neonate (62%) are male **gender** and three quarter of them (74%) **Birth weight** from 2.500 to less than 3.500 Kg and the majority (88%) of them borne with Cesarean section.

Table (3): Clarifies that more than half (57%) of studied nurses had good knowledge, about one quarter (24%) had average knowledge and only (19%) of them had poor knowledge about PPHN. In relation to studied nurses knowledge about persistent pulmonary hypertension this table show highly statistically significant different regarding total knowledge when p-value was <0.001**.

Table (4): Clarifies that the majority of studied nurses (82%) had positive attitude during caring for neonates with PPHN and only (18%) had negative attitude during caring for neonates with PPHN.

Table (5): Shows that, more than three quarter (76%) of studied nurses had competent practice during caring for neonates suffered from PPHN, and about one quarter (24%) of studied nurses had incompetent practice during caring for neonates suffered from PPHN. The same table also cleared that, highly statistically significant different regarding total practice when p-value was <0.001**-

Table (6): This table shows highly statistically significant correlation between total knowledge with total attitude and total practice and shows highly statistically significant correlation between total attitude and total practice when p-value was <0.001**.

Table (1): Characteristics of studied nurses (n=100).

Nurses Characteristics	N	%
Age		
20- <25	55	55
25- <30	29	29
30- <35	7	7
35 or more	9	9
Mean±SD	**28.45±5.31**	
Gender		
Male	14	14
Female	86	86
Training courses in PPHN		
Yes	28	28
No	72	72

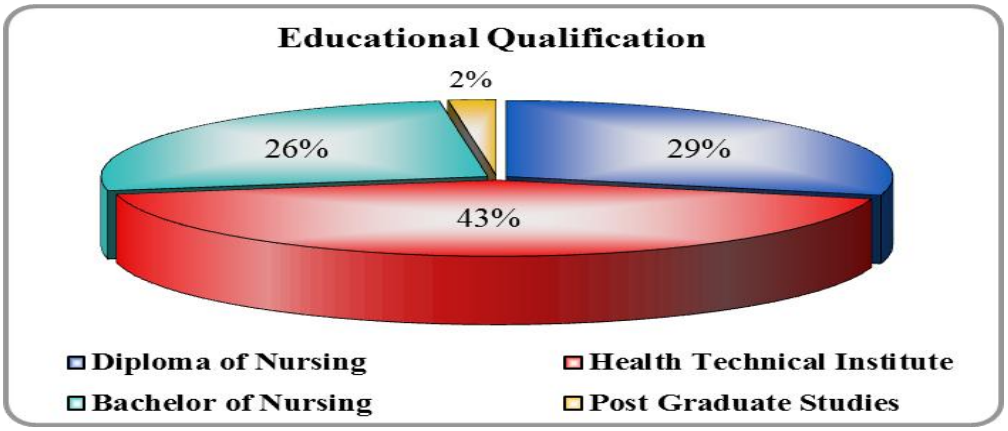

Figure (1): Distribution of studied nurses according to educational qualification.

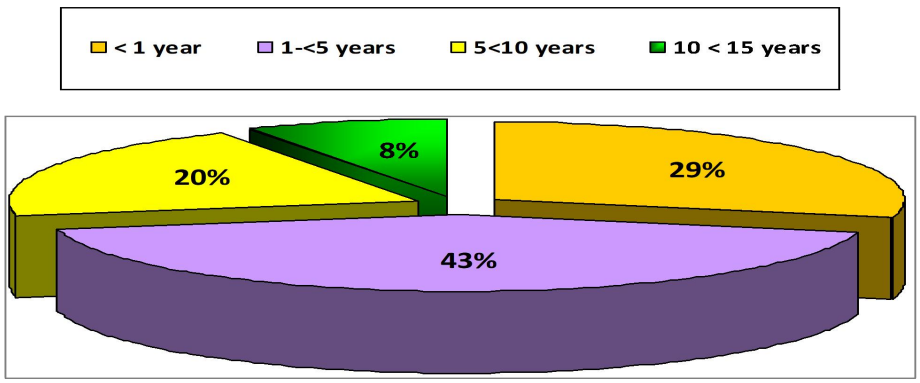

Figure (2): Distribution of the studied nurses according to their years of experience' .

Table (2): Characteristics of neonates (n=100).

Neonates characteristics	N	%
Chronological age		
Less than 24 hours	0	0
From 1 to less than 10 days	86	86
From 10 to less than 28 days	14	14
Mean ± SD	**12.57±3.62**	
Gestational age		
Less than 37 weeks	0	0
From 37 to 42 weeks	95	95
More than 42 weeks	5	5
Mean±SD	**40.78±2.53**	
Gender		
Male	62	62
Female	38	38
Birth weight/Kg		
Less than 1.500	0	0
From 1.500 to less than 2.500	0	0
From 2.500 to less than 3.500	74	74
From 3.500 or more	26	26
Mean±SD	**2.94±0.85**	
Type of labor		
Normal delivery	12	12
Cesarean section	88	88

Table (3): Total knowledge of studied nurses about PPHN.

Total knowledge	N	%	Chi-square X^2	Chi-square P-value
Good	57	57		
Average	24	24	**25.580**	**<0.001****
Poor	19	19		
Total	**100**	**100**		

Table (4): Total attitude among studied nurses.

Total attitude	N	%	Chi-square X^2	Chi-square P-value
Positive	82	82		
Negative	18	18	**40.960**	**<0.001****
Total	**100**	**100**		

Table (5): Total practice among studied nurses.

Total practice	N	%	Chi-square X^2	Chi-square P-value
Competent	76	76		
Incompetent	24	24	**27.040**	**<0.001****
Total	**100**	**100**		

Table (6): Correlation between Total knowledge with Total attitude and Total practice

		Total knowledge	Total attitude
Total attitude	R	0.461	
	P-value	<0.001**	
Total practice	R	0.640	0.606
	P-value	<0.001**	<0.001**

p >0.05 Non significant <0.001** High significant

Discussion:

Regarding to characteristics of staff nurses, the present study revealed that more than half of the staff nurses their age ranged between 20 < 25 years old, with mean 28.45±5.31. The majority of studied subjects were females and less than three quarters of the studied sample didn't have training courses. These results explained as nursing has traditionally been a female dominated industry, but the percentage of male nurses has increased gradually. These results supported with the study conducted by ***Abd El-Aziz et al., (2018)*** titled in (Improving nurses' performance towards non-pharmacological pain management among neonates In Neonatal Intensive Care Unit), detected that more than two third of staff nurses are females.

In addition, the current results demonstrated that less than half of studied nurses had Health Technical Institute, more than one quarter of them had diploma of nursing, about one quarter of them had bachelor of nursing. Related experience, more than one third of the studied nurses having years of experiences ranged from 1-< 5 years, while the minority of them having years of experiences ranged from 10<15 years. These results may due to the establishment of the Faculty of Nursing at Fayoum University recently; therefore, most of the nurses in Fayoum hospitals hold a technical institute or diploma. These results inconsistent with the study performed by ***Elsaleih et al., (2020)*** about assessment of neonatal nurses' performance regarding early detection of neurological dysfunction among neonates having hyperbilirubinemia, at Egypt with sample size 50 neonatal nurses and stated that more than half of studied nurses had diploma nursing and around one quarter of them had 10 <15 years' experience.

According to characteristics of studied neonates, the current study revealed that the most of studied neonates had gestational age from 37 to 42 weeks, the majority of them had chronological age from 1 to 10 days, more than half were male, three quarters of them had weight from 2.500 to 3.500g and the majority of them delivered through cesarean section, these result are based on the inclusion criteria are sets in selecting the studied neonates. These results disagreement with the study by ***Kherkheulidze et al., (2018)*** about evaluation of developmental outcomes in preterm infants with respiratory distress syndrome), and found that all of studied subjects were premature and gestational age mean was 32.11±2.4 weeks and mean weight was 2.380±215g.

According to total knowledge of studied nurses about PPHN, the current results demonstrated that more than half had good knowledge and about one quarter had average knowledge. These results explained as one quarter of them had bachelor nursing and more than one third had technical institute, also more than one quarter attended training courses. These results in cohort with the study performed by ***Wichaikull, (2017)*** titled in the establishment of nursing standard of prevention and caring for persistent pulmonary hypertension of newborn, at Bangkok with sample size 64 nurses and reported that majority of them had low knowledge about PPHN at preintervention.

The current study showed that more than two thirds had positive attitude about Follow the rules of infection control when dealing with neonates with PPHN. Also, the majority 82% of studied nurses had positive total attitude during caring for neonates with PPHN. These results may due to more than half had good knowledge and about three quarter had competent practice, which improving their attitude. These results regular with the study performed by ***Hendy et al., (2020)*** about Nursing Competency for Caring of High-Risk Neonates at Neonatal Intensive Care Unit, at Egypt with sample size 60 neonatal nurses and detected that slightly less than three quarters had positive attitude regarding care of HRNs.

Also, similar with the study by ***Williamson et al., (2020)*** about "Neonatal Nurses' Self-reported Practices, Knowledge, and Attitudes toward use of Maternal Voice for Preterm Infants", who stated that majority of neonatal nurses had positive attitude related their role prevention neonatal infection.

Related to level of total practice among studied neonatal nurses, the present study

detected that about three quarters of studied subjects had competent practice during caring for neonates suffered from PPHN, and about one quarter of studied subjects had incompetent practice during caring for neonates suffered from PPHN. These results explained as more than half of studied nurses had good knowledge, the majority of them had positive attitude and less than half of studied nurses had 5 years experiences which enhance nurses' practice. These results disagreement with the study by ***Mohammed & Abou Zed, (2019)*** about Effect of Instructional Guidelines on Nurses' Performance Regarding Care of High Risk Neonates Undergoing Surfactant Replacement Therapy, at Egypt with sample size 50 nurses and reported that nurses had low mean score 57.22 ± 7.08 with mean percent 57.2%.

Related correlation between total knowledge with total attitude and total practice, the present study revealed that there was highly statistically significant different between total knowledge with total attitude and total practice, total attitude and total practice $p<0.001$. These results congruent with the study performed by ***Ebrah & Yousif, (2020)*** about "The Effect of Intervention on Nurse's Performance Regarding Feeding of Premature Baby in Neonate Care Unit at Public Hospitals in Hodeida City: Yemen", with sample size 82 and indicated There was a statistical significance correlation between the total nurses' knowledge and their total practice's skill ($p < 0.05$). Also, regular with the study by ***Hegazy & Abusaad, (2019)*** about Nurses, Knowledge and Practices about Care of Neonates on Mechanical Ventilators with Respiratory Distress, at Egypt with sample size 68 nurses and revealed there was highly correlation between nurses' knowledge and their practice at p value <0.01.

Conclusion

Based on the study findings, it can be concluded that more than half of staff nurses had good knowledge about persistent pulmonary hypertension (PPHN). These results explained as one quarter of them had bachelor nursing, more than one third had technical institute and one only quarter attended training courses.

More than three quarter of staff nurses had competent practice during caring of neonates with (PPHN). These results explained as more than half of staff nurses had good knowledge and the majority of them had positive attitude which enhance nurses performance.

While the majority of staff nurses had positive attitude regarding caring of neonates with (PPHN). These result may due to more than half of staff nurses had good knowledge and more than three quarter of staff nurses had competent practice, which improving their attitude.

There were high statistically significant relation between total knowledge with total practice and total attitude and high statistically significant relation between total attitude and total practice.

Recommendations:

In the light of the study findings, the following recommendations were proposed:

1- In-services educational program must be developed for nurses to improve their knowledge about caring for neonates with persistent pulmonary hypertension with emphasizing follow up.
2- Continuous supervision and evaluation of nurses' performance should be performed regarding developmental care during caring for neonates with persistent pulmonary hypertension in hospitals to achieve and maintain the quality of care.
3- Standardized nursing procedure booklets and guidelines for the nurses should be available to guide them for giving the adequate care for neonates with persistent pulmonary hypertension.
4- Nurses should be trained well on the competent level of practice regarding care given to neonates with persistent pulmonary hypertension.

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