Improving Nurses' Performance regarding Noninvasive Continuous Positive Airway Pressure for Neonates: Application of Clinical Pathway

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Abstract

Background: Noninvasive continuous positive airway pressure is represents applying a constant positive pressure at the airway opening during the spontaneous breathing, its use is common and reducing the need for mechanical ventilation in neonates with respiratory distress syndrome. Clinical pathway provides detailed steps for each stage in the management of neonates with a specific condition in a determined period and include progress and outcomes details**. Aim of the study was** to improve the nurses' performance regarding noninvasive continuous positive airway pressure for neonates. **Design:** A quasi- experimental design was used in the current study. **Settings:** The study was carried out at Neonatal Intensive Care Units at Benha University Hospital and Benha Specialized pediatric Hospital at Benha city. **Subjects:** All available nurses (60) nurses who working at previously mentioned settings and a purposive sample of (60) neonates on noninvasive continuous positive airway pressure. **Tools of data collection**: **Tool (1):** A structure interview questionnaire format including subjects' characteristics and nurses' knowledge regarding care of neonates undergoing noninvasive continuous positive airway pressure. **Tool (II):** Clinical pathway checklists. **Results:** The majority of studied nurses had a poor level of knowledge at pre-clinical pathway application compared with most of them had a good level of knowledge post clinical pathway application map for care of neonates, most of studied nurses had incompetent practice level pre-clinical pathway application compared with more than three quarters had competent practice level regarding post clinical pathway application. **Conclusion:** Application of clinical pathway improved nurses' knowledge and practice regarding noninvasive continuous positive airway pressure for neonates. **Recommendations:** Provision of continuous education by using clinical pathways to update nurses' knowledge and enhance their practices regarding care of neonates on noninvasive continuous positive airway pressure**.**

Keywords: Neonates, Noninvasive Continuous Positive Airway Pressure, Nurse Performance, Clinical Pathway

Introduction:

The neonatal period is the first four weeks of the life of the infant. The neonate undergoes marked physiological changes that occur in all organ systems especially regarding the respiratory system during this time, major function of the respiratory system is to provide oxygen for metabolism and remove carbon dioxide **(Rey y., et al, 2022)**. The metabolic demands of tissues remain application unfulfilled and body systems rapidly fail, without an adequate exchange of oxygen and carbon dioxide. When oxygenation and ventilation are inadequate Continuous Positive Airway Pressure is needed **(I.liu et al., 2019).**

Respiratory support is a very important care for neonates. Both non-invasive modalities and invasive mechanical ventilation may be used for neonates with respiratory problems such as respiratory distress, apnea and meconium aspiration (**Anne & Murki, 2021).** Delivery of constant positive pressure to the airway of a spontaneously breathing neonate maintains adequate functional residual capacity within the alveoli for prevention atelectasis and improving oxygen and carbon dioxide exchange within the pulmonary circulation **(Kavanagh et al., 2016).**

Continuous Positive Airway Pressure acts by improving the functional residual capacity of the lungs by exceeding the closing capacity of the lungs, which steadily prevents the collapse of alveoli, making inflating the lungs easier. It also provides a splint to the chest wall and airway. producing increased lung volumes, recruitment of atelectatic alveoli, and prevention of further atelectasis. Majority of infants who are having respiratory problems as distress, lung collapse when CPAP is indicated, it decreases the compliance of the chest wall and allows for easy breathing, causing in a decreased effort of breathing,

improved gas exchange and improved cardiac function (**stanley & Agrawal, 2016).**

Continuous Positive Airway Pressure is indicated for preterm neonates before 30 wks., very low birth weight less than 1500gm., also at post-extubating with oxygen requirements 30% or more to maintain oxygen saturation (SPO2) 92-96%,or signs of mild to moderate respiratory distress syndrome including (tachypnea more than 60 cycle/minute, audible respiratory grunting, sterna, intercostal, lower coastal recessions, nasal flaring, and cyanosis) depending on chest radiography and blood gases of partial pressure of oxygen (PaO2) <50-60 mmHg **(Zhu *et al.*, 2022).**

Contraindications of nasal continuous positive airway pressure include impending respiratory failure or $PaCO_2$>60%, PH< 7.25, FiO_2>0.4, Downes score ≥7, pneumothorax,poor respiratory efforts, cardiovascular instability, neonatal congenital anomalies as bilateral choanal atresia, congenital diaphragmatic hernia, trachea esophageal fistula, cleft lip, or cleft palate and unrepaired gastroschisis **(Luo *et al.*, 2022).**

Excessive CPAP may contribute to lung overinflation, increasethe risk for air leaks, increase intrathoracic pressure, and decrease venous return and cardiac output. CPAP may result in carbon dioxide retention and impaired gas exchange if set too high. In addition, gastric distension is a commonly encountered problem and can be at least partially alleviated by placing an orogastric tube **(Seigel, 2018).**

Clinical Pathways are evidence – based multidisciplinary care plans which describe the essential needed steps in the care of neonates with a specific clinical problem. It is used to translate clinical guidelines into local protocols and clinical practice. Whereas clinical guidelines provide generic recommendations, CPWs

are specifically tailored to the local hospital structures, systems and time-frames used (**Chuter et al., 2022**).

The benefits of clinical pathway, enhancing the quality of care, improving patient outcomes, promoting patient safety, increasing patient satisfaction, and optimizing the use of resources". The facilitation of the communication among the team members and with patients and families. Reduction of unnecessary variation in care and reduction in hospital length of stay. The coordination of the care process by coordinating the roles and sequencing the activities of the multidisciplinary care team, patients and their relatives. The documentation, monitoring, and evaluation of variances and outcomes, and the identification of the appropriate resources **(Gartner et al., 2022).**

The nurse plays an important role in family support for parents who have a neonate at NICU that causes social, cultural influences and affects the parental approach for communication, coping and care decisions. The responsibility of neonatal nurse and other members of the health team are informing the family about the reason for the nasal CPAP including the benefits and possible complications **(Ferreira & Cruz, 2022).**

Nurses have a key role in all aspects of clinical pathway use. Participating in the development of the pathway is the first step. Because the nurses begin and the chain of staff involved in delivering care, nurses possess a unique perspective in how health care systems work to enhance or impede the delivery of care. Nurses are also responsible for initiating the pathway on appropriate patients and ensuring that various events occurred **(Abbott et al., 2022).**

Significance of the study:

Millions of neonates' infants are at risk of mortality and at risk for

developing more and serious morbidities. Respiratory distress is a main health problem that occurs in the newborn stage. In Egypt 46.5 % admitted to neonatal intensive care unit had respiratory distress. Over the past two decades, there has been an evident increase in the use of non-invasive continuous positive airway pressure. CPAP therapy is widely used in neonates, while the clinical nursing practice differs, and an inappropriate method of application may delay the treatment and increase complications. Therefore, the researchers found urgent to conduct this research to increases nurses' knowledge and improving their clinical practice about nursing care of neonates receiving continues positive airway pressure.

Aim of the study

The aim of this study was to improve the nurses' performance regarding noninvasive continuous positive airway pressure for neonates.

Research hypothesis

Nurses' performance for caring of neonates receiving noninvasive continuous positive airway pressure are expected to improve after clinical pathway application.

Research design:

A quasi-experimental design was utilized to achieve the aim of the current study. The manipulation of independent variables to observe the effect on dependent variables.

Settings:

The study was conducted at Neonatal Intensive Care Units (NICUs) at Benha University Hospital and Benha Specialized pediatric Hospital affiliated to Ministry of Healthat Benha city.

Subjects:

All available nurses (60) nurses who work at previously mentioned settings regardless of their personal characteristics and willing to participate in the study.

Tools of Data collection:

Data were gathered collected by using the following tools:

Tool I : A structure interview questionnaire format:

It was designed by the researchers in the light of current relevant studies and research to assess personal and medical data for the studied subjects, it was written in simple Arabic language to suit study sample. It is composed of the following parts:

Part (1): **Characteristics of the studied nurses:** such as age, gender, educational qualifications, years of experience in NICUs, place of work, and attendance of training program related to care of neonates undergoing NICPAP (6 questions).

Part (2): **Medical data of the studied neonates** such as gestational age, gender, birth weight, current weight, medical diagnosis, number of days for neonates undergoing NICPAP and methods of NICPAP delivery for neonate (7questions).

Part (3): Nurses' knowledge regarding NICPAP: It was developed by the researchers guided by **Dewez et al., (2018)** and **Seigel, (2018)** and revised by supervisors to assess nurses' knowledge regarding NICPAP. It included knowledge related to definition, types, functions, indications, complications of CPAP, time of changing CPAP connection, signs for administration CPAP, obstacles, components and efficiency of CPAP, the time for weaning from CPAP, obstacles of weaning. This part included (12) questions in the form of multiple-choice questions.

Part (4): **Nurses' knowledge regarding care of neonates undergoing NICPAP:** It was developed by the researcher guided by **Bowden &Greenberg, (2016)** to assess nurses' knowledge regarding care of neonates undergoing NICPAP**.** It consists of (34) multiple choice questions, categorized under 5 main

categories, questions related to suction, oxygen therapy, blood gases technique, feeding for neonates and infection control in NICU.

Part (5): Nurses' knowledge regarding clinical pathways: It was developed by the researcher guided by **Pirog et al. (2015) and Warner et al. (2020),** to assess nurses' knowledge regarding clinical pathways. It consists of multiple-choice questions which included definition, goals, elements, steps, nursing role, benefits of a clinical pathway for nurses and neonates, barriers, types of deviation, definition and cause of negative deviation, definition and cause of positive deviation. This part included (13) questions.

Part (6): Nurses' knowledge regarding multidisciplinary team management: It was developed by the researchers guided by **Weizi et al. (2014),** to assess nurses' knowledge regarding multidisciplinary team management. It consists of multiple questions. This part included (5questions).

Part (7): Nurses' knowledge regarding implementing the Clinical pathway care map in the care of neonates undergoing NICPAP: This map was adapted from ***National Health Services (2009).*** The researchers modified the clinical pathway formats and contents and reviewed them with the research supervisors to suit the nature of the study.

Scoring system:

The studied nurses' answers were compared with a model key answer and scored as; "2" for complete correct answer, (1) for incomplete correct answer, and "zero" for the incorrect or unknown answer, total knowledge scores ranged from (0-192) point. In this respect, the level of nurses'

knowledge was categorized as the following: good level knowledge ≥ 80% was ranged from (154-192), average level knowledge from 60% < 80% ranged from (116 to < 154) and poor level knowledge < 60 % ranged from (0-115).

Tool (II) - Clinical pathway checklists: it was adopted from **Bowden & Greenberg**, ***(2016).*** It was used to assess nurses' practice level regarding nursing care for neonates undergoing NICPAP. It contained 129 steps under main (9) procedures as assisting in extubating (10 steps), care of neonate after extubating (13 steps), NICPAP application (7 steps), connect neonates on NICPAP (13 steps), care of neonates on NICPAP (13 steps), administration of oxygen therapy by nasal cannula, oxygen hood and mask oxygen (12 steps), suctioning (25 steps), taking capillary blood gases (14 steps) and gavage feeding (22 steps).

Scoring system:

Nurses' responses were scored as follows: (1) done completely and (zero) not done, so the total practice scores (129) points. Accordingly, nurses' practice level is as follows: Competent level was ≥80% ranged from (103- 129) and incompetent level < 80% ranged from (0- 103) degrees.

Tools validity and reliability:

Tools of data collection were translated into Arabic and investigated for its content validity by three expert's (three professors of pediatric nursing from the Faculty of Nursing at Benha University), who are selected to test the content validity of the instruments and to judge its clarity, comprehensiveness, relevance, simplicity and accuracy. All of their remarks were taken into consideration; some items were re-phrased to arrive at the final version of the tools. The tools were regarded as valid from the experts' point of view.

Reliability of the tools was examined by using Cronbach's

Alpha Coefficient test to measure the internal consistency for all tools; Tool (I) - A structure interviewing questionnaire format which include nurses' knowledge regarding noninvasive continuous positive airway pressure was 0.92, care of neonates under NICPAP was 0.83, clinical pathway was 0.88, clinical pathway map was 0.88, Tool (II): Clinical pathway checklists were 0.96 that, reflect accepted internal consistency of the tools.

Ethical consideration:

Written approval was obtained from the Ethical Committee of Faculty of Nursing Benha University. The researchers clarified the aim of the study to the studied nurses. Verbal approval was prerequisite to participate in the study. Nurses were assured that all gathered data was used for research purposes only and the study was harmless. Additionally, nurses allow to withdrawal from the study at any time without giving the reason. Confidentially of the gathered data and results were secured

Pilot study:

A pilot study was conducted to test the clearness and applicability of the study tools and estimate the time needed for each tool. It was done on 10% of the total subjects, (6) neonates undergoing NICPAP and (6) nurses who excluded from the present study to avoid sample bias. In the light of pilot study analysis, modification was done, and the last form was developed.

Field work:

The Clinical pathway application was implemented to achieve the aim of the current study, assessment, planning, implementation and evaluation phases. These phases were conveyed from the earliest starting point from the first of September 2021 to the end of May 2022 covering 9 months.

Assessment phase:

This phase involved interviews with nurses to collect baseline data. It took about (16

weeks), the researcher was available four days/week; (Saturday, Monday) at Benha University Hospital (Tuesday and Thursday) at Benha Specialized Pediatric Hospital by rotation from 11.00 AM and extended to 1.30 PM hour. The average number collected was 2-3 nurses per /day. At the beginning of the interview, the researchers welcomed each nurse, explained the purpose, duration and activities of the study and took written consent from nurses. After that, the pre-test was done using tools. Each nurse was asked to fill the questionnaire sheet (pre/post) for 15-20 minutes to assess their knowledge regarding the clinical pathway and care of neonates on NICPAP; the actual nurses' practice was assessed by using the tool of observational checklists and it took30 minutes.

Planning phase:

Clinical Pathway application was designed based on the actual needs assessment of nurses then implemented and evaluated. The application of the clinical pathway was carried out in the previously mentioned study settings with the studied nurses whereas, (the theoretical contents were provided through three teaching sessions; the practical contents were provided through nine sessions, each session took 60 minutes). Training sessions included teaching and learning methods, media that were lecture, video, PowerPoint presentation, hand out, group discussion, brainstorming, flip charts, pictures, real situation, demonstration and re-demonstration.

Implementation phase:

Toward the start of the clinical pathway application, a direction to the motivation behind clinical pathway took place and the nurses were informed about the time and place of sessions. The contents of the clinical pathway were prepared in the light of actual needs assessment of the studied nurses after reviewing the related literature. It took about 16 weeks for clinical

pathway application. The studied nurses were divided into 10 groups each group consisted of 6 nurses, the clinical pathway application has taken 12 hours for each group, the program consisted of 12 sessions, distributed as the following; (3) session for theoretical part each session kept going 60 minutes and (9) session for practical part, each session kept going one hour, 4 days/week in the morning shift and were implemented according to nurses readiness. These sessions were repeated to each subgroup of nurses. **Theoretical part as the following**: **first session** of clinical pathwayaimed toidentify the purpose of clinical pathway and overview about noninvasive continuous positive airway pressure, **second session**aimed toincrease knowledge of clinical pathway included definition, aims, elements, steps, barriers**,** benefits of clinical pathway for nurses and for patients, types and causes of variances, **third session**aimed toincrease knowledge about multidisciplinary team roles in caring of neonates on NICPAP.

Practical part concerned with application of care related to ;fourth session aimed to how to perform technique of NICPAP connection, **fifth session**aimed to how to applynursing care for neonates undergoing NICPAP, **sixth session**aimed to how to applyweaning of neonates from NICPAP, **seventh session**aimed to how to performtechnique of physiotherapy for neonates**, eighth session,** aimed to how to performtechnique of suctioning for neonates, **ninth session,** aimed to how to applyoxygen therapy technique in neonates**, tenth session** aimed to how to performtechnique of blood gases sampling for neonates on NICPAP**, eleventh session**aimed to how to performtechnique of gavage feeding for neonates on NICPAP and **twelfth session**aimed to how to applyinfection control for neonates on NICPAP.

At the end of each session, the researcher summarized the key topics and verifies that the nurses understand the information presented.

Evaluation phase:

Post clinical pathway application, the posttest was carried out to assess the effect of clinical pathway on nurses' performance and neonatal outcome undergoing NICPAP by using the same pretest format as a posttest which took one month.

Statistical analysis:

Computerized data entry and statistical analysis were fulfilled using the Statistical Package for Social Sciences (SPSS) version 25. Chi square test for qualitative data was used to compare data between the different time points. Pearson's Correlation coefficient (r) was used to the relationship between the variables. The relationship between personal data and study variables was tested using chi square test. statistically significant was considered at P-value ≤ 0.05organized, analyzed and represented in tables and graphs as required. Data were presented using descriptive statistics in the form of Number, frequency **distribution** for description, highly significant at P-value ≤ 0.001, insignificant at P-value > 0.05

Results:

Table (1): shows that, less than two thirds (63.3%) of the studied nurses were in the age group 20 to < 25 years with mean age 23.80 ± 3.07 years, nearly two thirds (65.0%) had Bachelor of Nursing Science. While, slightly more than two thirds (66.7%) had experienced < 5 years in NICU. The majority (85.0%) of them didn't attend training course regarding care of neonates on NICPAP

Table (2): demonstrates that, more than two-thirds (66.7%) of the studied neonates were in gestational age group from 32 to <36weeks with mean age 36.13 ± 1.73 weeks, half (50%) had weight admission from

2000 to < 2500 gm. while, more than half (53.3%) had current weight from 2000 to < 2500 gm. More than two thirds (71.7%) suffering from respiratory distress syndrome on admission.

Figure (1): reveals that the most (96.7%) of studied nurses had a poor level of knowledge at pre-clinical pathway application compared with most (90.0%) had a good level of knowledge regarding care of neonates undergoing NICPAP after clinical pathway application.

Figure (2): illustrates that, most of studied nurses (98.3%) had incompetent practice level regarding pre-clinical pathway application compared with more than three quarters (76.7%) had competent practice level regarding clinical pathway application.

Table (3) shows that there was highly statistically significant relation between total nurses' knowledge regarding clinical pathway application d their year of experience of nurses at pre and post intervention phases. While there were no statistically significant relation between total nurses knowledge regarding clinical pathway application and their age and attending training course regarding NICPAP.

Table (4) shows that there was statistically significant relation between total nurses' practice regarding preclinical pathway application and their years of experience and educational level at pre and post clinical pathway application. While there were no statistically significant relation between total nurses' practice regarding implementing clinical pathway application and their age and attending training courses regarding NICPAP.

Table (5): Reveals that, there is a highly statistically significant with a positive correlation between nurses' total knowledge and practice regarding clinical pathway and

NICPAP in neonates at post clinical pathway application (P < 0.001).

knowledge score. With a p-value of less than 0.001, the difference between the total knowledge and total practice scores was highly statistically significant.

Table (1): Distribution of the studied nurses according to their characteristics (n=60).

Characteristics	No.	%
Age / years		
<20	2	3.3
20 - <25	38	**63.3**
25 - <30	16	26.7
≥ 30	4	6.7
x̄ ± SD 23.80 ± 3.07 Years		
Educational level		
Secondary School of Nursing	2	3.3
Technical Institute of Nursing	17	28.4
Bachelor of Nursing Science	39	**65.0**
Post-graduate Studies	2	3.3
Years of experience in Neonatal Intensive CareUnits		
< 5 years	40	**66.7**
5 - < 10 years	18	30.0
≥ 10 years	2	3.3
x̄ ± SD 4.15 ± 6.61 Years		
Attended training course regarding care of neonates undergoing NICPAP		
Yes	9	15.0
No	51	**85.0**
Number of training course (n=9)		
One time	7	**77.8**
Two time	2	22.2

Table (2): Distribution of the studied neonates according to their characteristics (n= 60).

Characteristics	No.	%
Gestational age / weeks		
28 < 32	5	8.3
32 - < 36	40	**66.7**
36 - ≤ 40	15	25.0
x̄ ± SD 36.13 ± 1.73 Weeks		
Current age / days		
<5	14	23.3
5<10	42	**70**
10≤ 15	2	3.3
.> 15	2	3.3
x̄ ± SD8.01± 2.75 days		
Weight on admission/ gms.		
1500 -<2000 gm	15	25.0
2000 -<2500 gm	30	**50.0**
2500 -<3000 gm	10	16.7
3000 ≤ 3500gm	5	8.3
x̄ ± SD2461.66 ± 749.93 gm.		
Current weight/ gms.		
<2000 gm	16	26.7
2000 -<2500 gm	32	**53.3**
2500 -<3000 gm	8	13.3
3000 -<3500gm	2	3.3
≥3500gm	2	3.3
x̄ ± SD2484.16± 708.39gm.		
Medical Diagnosis		
Respiratory Distress Syndrome	43	**71.7**
Diabetes Mellitus	7	11.7
Premature	10	16.6

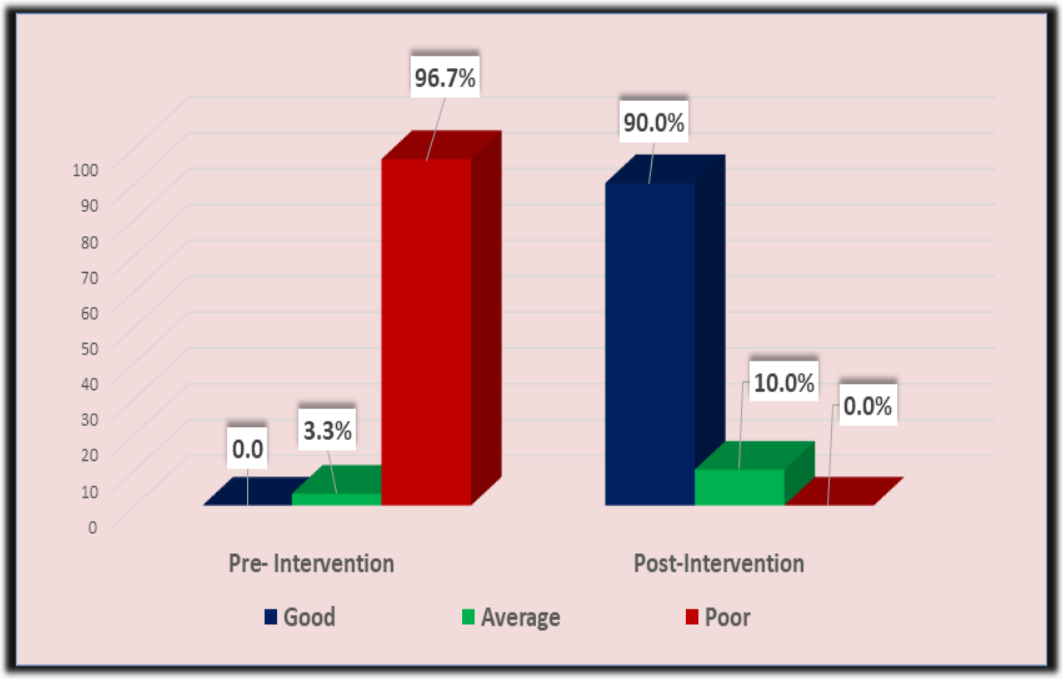

Figure (1): Distribution of total nurses' knowledge level regarding care of neonates undergoing NICPAP at pre and post clinical pathway application phase.

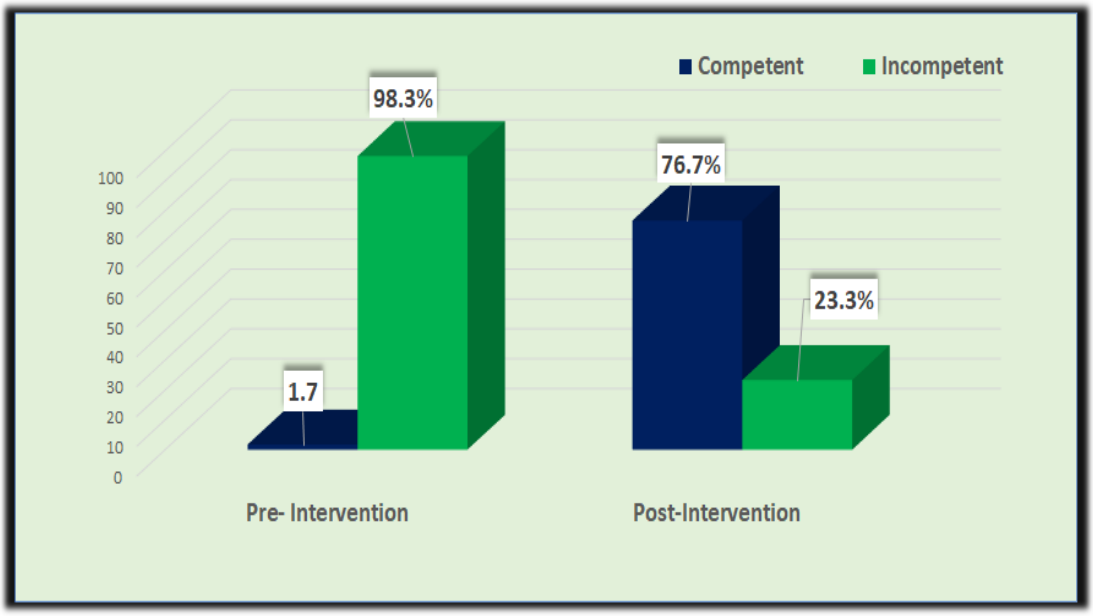

Figure (2): Distribution total level of the studied nurses' practice regarding care of neonates undergoing NICPAP at pre and clinical pathway application phase.

Table (3): Relation between nurses' total knowledge score and their characteristics pre and post clinical pathway application (60).

Characteristics	Total Knowledge Pre- clinical pathway application (n=60)				χ2/FET	(P-Value)	Total Knowledge Post- application (n=60)				χ2/FET	(P-Value)
	Poor ((n= 58)		Average (n=2)				Average(n=6)		Good (n=54)			
	No.	%	No.	%			No.	%	No.	%		
Age / years												
< 20	2	3.4	-	-	1.198	0.754	-	-	2	3.7	1.380	.710
20:< 25	36	62.1	2	100.0			4	66.7	34	63.0		
25:< 30	16	27.6	-	-			2	33.3	14	26.0		
≥ 30	4	6.9	-	-			-	-	4	7.3		
Educational level												
Secondary School of Nursing	2	3.4	-	-	7.683	0.021*	-	-	2	3.7	11.742	0.003*
Technical Institute of Nursing	17	29.4	-	-			1	16.7	16	29.6		
Bachelor of Nursing Science	38	65.5	1	50.0			4	66.6	35	64.9		
Post-graduate Studies	1	1.7	1	50.0			1	16.7	1	1.8		
Years of experience in neonatal care												
< 5 years	38	65.5	2	100.0	0.445	0.884	4	66.7	36	66.7	13.697	0.000**
5:< 10 years	18	31.0	-	-			2	33.3	16	29.6		
≥ 10 years	2	3.4	-	-			-	-	2	3.7		

Conti. Table (3): Relation between total scores of studied nurses' knowledge and their characteristics pre and post clinical pathway application (60).

Characteristics	Total Knowledge Pre- clinical pathway application (n=60)				χ2/FET	(P-Value)	Total knowledge Post clinical pathway application (n=60)				χ2/FET	(P-Value)
	Poor (n=58)		Average (n=2)				Average(n=6)		Good (n=54)			
	No.	%	No.	%			No.	%	No.	%		
Attended training course regarding NICPAP					0.818	0.510					0.491	.449
Yes	7	12.1	2	100.0			1	16.7	8	14.8		
No	51	87.9	-	-			5	83.3	46	85.2		

Table (4): Relation between nurses' total practice score and their characteristics pre and post clinical pathway application (60).

Characteristics	Total practice Pre- clinical pathway application (n=60)				χ2/FET	(P-Value)	Total practice Post clinical pathway application (n=60)				χ2/FET	(P-Value)
	Incompetent(n=59)		Competent (n=1)				Incompetent (n=14)		Competent (n=46)			
	No.	%	No.	%			No.	%	No.	%		
Age / years												
< 20	2	3.4	-	-	0.923	0.899	-	-	2	4.4	3.715	.294
20:< 25	37	62.7	1	100.0			9	64.3	29	63.0		
25:< 30	16	27.1	-	-			5	35.7	11	23.9		
≥ 30	4	6.8	-	-			-	-	4	8.7		
Educational level												
Secondary School of Nursing	2	3.4	-	-	5.48	0.832	1	7.1	1	2.2	4.202	.042*
Technical Institute of Nursing	17	28.8	-	-			6	42.9	11	23.9		
Bachelor of Nursing Science	38	64.4	1	100.0			7	50.0	32	69.6		
Post-graduate Studies	2	3.4	-	-			-	-	2	4.3		
Years of experience in neonatal care												
< 5 years	39	66.1	1	100.0	0.819	0.664	11	78.6	29	63.0	7.766	.005**
5:< 10 years	18	30.5	-	-			3	21.4	15	32.6		
≥ 10 years	2	3.4	-	-			-	-	2	4.4		

Conti. Table (4): Relation between total scores of studied nurses' practice and their characteristics pre and post clinical pathway application (60).

Characteristics	Total practice Pre- clinical pathway application (n=60)				χ2/FET	(P-Value)	Total knowledge Post clinical pathway application (n=60)				χ2/FET	(P-Value)
	Incompetent (n=59)		Competent (n=1)				Incompetent (n=14)		Competent (n=46)			
	No.	%	No.	%			No.	%	No.	%		
Attended training course regarding clinical pathway and NICPAP					0.673	0.717					0.490	.351
Yes	9	15.2	-	-			5	35.7	4	8.7		
No	50	84.8	1	100.0			9	64.3	42	91.3		

Table (5): Correlation between nurses' total knowledge and total practice pre and post clinical pathway application (n=60).

	Pre- clinical pathway implementation		Post clinical pathway implementation	
	r	P value	r	P value
Knowledge	0.246	0.034*	0.650	0.000**
Practice	0.331	0.029*	0.815	0.000**

Discussion:

The neonatal period is a very important period in neonate life. Many transitional changes particularly in the respiratory system. Non-invasive continuous positive airway pressure has become the preferred method of respiratory support for neonates with respiratory problems. A clinical pathway is a method for the patient-care management of a well – defined group of neonates during a well-defined period of time ***(Debleser etal, 2017).***

This study was conducted to improve the nurses' performance regarding noninvasive continuous positive airway pressure for neonates**.**

As regards the age of the studied nurses, the present study revealed that more than half of the studied nurses within age from 20 to less than 25 yrs with mean age23.80 ± 3.07 years. This finding consistent with ***Tawfiket al. (2015)*** in a study entitled "Assessment of nursing care provided to neonates with respiratory distress" who reported that, half of the studied nurses within age from 20≤ 25 yrs. From the researcher's point of view, this may be due to the appointment of new staff from newly graduated nurses each year in the hospital.

Regarding the qualifications of the studied nurses, the present study revealed that nearly two thirds of the studied nurses had a Bachelor of Nursing Science. The finding of this study disagreed with ***Mansour et al., (2019)*** in a study entitled "assessment nurses' knowledge and practices

related neonatal sepsis in neonatal intensive care units at Elmania Hospitals who reported that, only one quarter of the studied nurses had Bachelor of Nursing Science. From the researcher's point of view, this may be due to the reason that the critical areas such as neonatal intensive care units need qualified nurses.

As regards the years of experience of the studied nurses, the present study revealed that more than two thirds of the studied nurses had less than five years of experiences with mean 4.15 ± 6.61 Years. The finding of this study agreed with ***Abd-Elbaky et al. (2018)*** in a study entitled "Impact of simulated education program on nurses' performance of invasive procedure at intensive care units" who reported that, the majority of the studied nurses had less than five years of experiences. From the researcher's point of view, this result may be due to the young age of the studied nurses, the decrease in the nurses' experience year may affect on their performance level which may affect on their practice.

The present study showed that the majority of the studied nurses didn't attend training courses for neonates on NICPAP. The finding of this study was agreed with ***Elsobky &Mohamed (2018)*** in a study entitled "Effect of educational guidelines program about nursing care of neonates receiving CPAP" who found that, two thirds of the studied nurses didn't attendance training courses for neonates on NICPAP. The researchers believe that the hospital should provide continuous training for neonatal intensive care nurses to gain and update their knowledge and practices about CPAP.

Regarding the medical diagnosis of the studied neonates on NICPAP, the present study revealed that, more than two thirds of the studied neonates had respiratory distress syndrome. This finding in accordance with the finding of the study reported by ***Elsobky &Mohamed (2018)*** in a study

entitled "Effect of educational guidelines program about nursing care of neonates receiving CPAP" who found that, the most causes of neonatal admission to the NICU was respiratory distress syndrome.

According to the gender of the studied neonates on NICPAP, the present study revealed that more than half the studied neonates were females. This result was disagreed with ***zhu, (2017)*** in a study entitled "Effect of using clinical pathway on nursing care of neonates with respiratory distress syndrome" who reported that, the majority of the studied neonates were female.

Concerning the total score of the nurse's knowledge regarding application of clinical pathway care map activities pre, post implementation, the present study illustrates that, the majority of the studied nurses had poor knowledge pre-clinical pathway implementation, while improved to the majority of the studied nurses had good knowledge post clinical pathway application. The finding of this study agreed with ***Abd Elmenem et al. (2015)*** who reported that all of the studied nurses had poor knowledge pre-clinical pathway application, while the majority of them had a good knowledge post application. In the same line, this result was supported by **Mohamed *et al.* *(2014),*** in a study entitled "The effect of a clinical pathway on outcome of children" it showed a very highly statistically significant difference between the study group and control group in relation to clinical pathway activities.

Concerning nurses' total level of practice of care provided to neonates on NICPAP pre and post clinical pathway application, the present study illustrated that, the implementation had a greater effect on improving studied nurses practice at post clinical pathway application compared with the pre-clinical pathway application. The finding of this study agreed with ***Milligan & Goldstein, (2017)*** in a study entitled "Implementation of an

evidence-based non-invasive respiratory support (NIRS) bundle in the NICU to decrease nasal injury complications" who revealed that, the intervention had a greater effect on improving studied nurses practice at post clinical pathway intervention compared with the pre-clinical pathway application. From the researcher point, improvement in nursing practice after implementation of the clinical pathway application may be due to efficient application of the clinical pathway application and the readiness of the studied nurses to improve their level of practice

Concerning relation between total nurses' knowledge and their characteristics pre and post clinical pathway application, the present study showed that, there was statistically significant relation between the studied nurses' total score of knowledge and their years of experience and their educational level. The finding of this study was supported by ***Abd Elmageed et al. (2020)*** in a study entitled"Knowledge, Attitude and Practice of Nurses in Administering Medications "who found that, there was a statistically significant relation between nurses' level of knowledge and years of experience. The finding of this study is consistent with ***Mohamed et al. (2020))*** who found that there is a statistically significant relation between nurses' knowledge and their qualifications. From the researcher's point of view, this result may indicate that the ability to acquire knowledge increased with high educational level and years of experience.

Concerning the relation between total nurses' knowledge and their characteristics, the present study showed that, there was no significant relation between the studied nurses' total score of knowledge and their age, attended training course regarding NICPAP. These findings of this study are in agreement with ***Mohamed et al. (2019)*** who reported that, there was no significant statistical difference

between total nurses' knowledge scores the care of neonates undergoing mechanical ventilation and their age. This result may indicate that the ability to acquire knowledge not depend on the studied nurses age.

Concerning relation between total nurses practice' and their characteristics pre and post clinical pathway intervention, the present study showed that, there was a significant relation between the studied nurses' total score of practice and their years of experience and their educational level. These findings of this study disagreed with ***Mostafa et al. (2019)*** in a study entitled"who reported that there was a statistical significance between total qualifications score and total practice score. From the researcher's point of view, this indicates that high level of education for nurses, effect on their level of performance and efficient of care.

Concerning correlation between nurses' total knowledge and total practice regarding care of neonates on NICPAP pre and post clinical pathway application, the present study revealed that there was a very highly positive statistically significant correlation between nurses' knowledge and total practice pre and post clinical pathway application. The finding of this study congruent with ***Abd Elmenem et al. (2015)*** who found that, there was a very high statistically significant correlation between nurses' knowledge regarding clinical pathway and application clinical pathway care map pre, post intervention of nursing clinical pathway. From the researcher's point of view, this may indicate that the nurse knowledge affects their practice. Lack of knowledge may have an effect on nurses' practice regarding care of neonates on NICPAP

Conclusion:

Based on the result findings, the study concluded that: application of the nursing clinical pathway can improve the nurses' performance and neonatal outcomes regarding noninvasive

continuous positive airway pressure through increasing the nurses' knowledge, enhancing their practice regarding NICPAP, reduce the length stay for the neonates.

Recommendations:

Based on the findings of the current study, it was recommended that**:**

- Provision of Continuous education program for all nurses working in NICU about using clinical Pathway for updating of their knowledge and practices regarding care of neonates undergoing NICPAP.
- Designing and distributing a manual booklet about the use of clinical pathway to all nurses who are caring neonates undergoing NICPAP.
-Further studies need to be carried out to assess the effectiveness of clinical pathway applications in care of neonates on NICPAP and outcomes using larger sample size and determined the neonates' inclusion criteria

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