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EFFECT OF STRUCTURED TEACHING PROGRAM ON KNOWLEDGE AND PRACTICE OF NURSES ABOUT THE CARE OF CONTINUES POSITIVE AIRWAY PRESSURE (CPAP) THERAPY IN NEONATES

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Abstract

Background: *Continuous Positive Airway Pressure (CPAP) is a non-invasive ventilation strategy widely used in Neonatal Intensive Care Units (NICUs) to manage respiratory distress in neonates. Despite its effectiveness, many nurses lack adequate knowledge and practical skills to administer CPAP safely, particularly in resource-limited settings like Pakistan.*

Aim: *This study aimed to evaluate the effect of a structured teaching program on nurses' knowledge and practice regarding the care of neonates receiving CPAP therapy.*

Methods: *A quasi-experimental design was adopted with pre- and post-intervention assessments. A total of 50 nurses from the Children's Hospital Lahore were selected using purposive sampling. Data were collected using a validated questionnaire and an observation checklist. The structured teaching program consisted of six sessions (three theoretical and three practical), focusing on CPAP fundamentals, indications, complications, and clinical practices. Data were analyzed using SPSS version 24 with paired t-tests to assess knowledge and practice improvements.*

Results: *Pre-intervention results indicated major knowledge and practice gaps among nurses, with correct responses in key areas ranging from 38% to 48%. Post-intervention findings showed significant improvement, with correct response rates rising to 70%–88%. The paired t-test revealed statistically significant increases in both knowledge ($p < 0.001$) and practice ($p < 0.001$), demonstrating the program's effectiveness.*

Conclusion: *Structured educational interventions significantly enhance nurses' competencies in CPAP management for neonates. Regular training and reinforcement are essential to ensure high-quality, evidence-based neonatal care*

INTRODUCTION

Major function of the respiratory system is to provide oxygen for metabolism and remove carbon dioxide. The metabolic demands of tissues remain unfulfilled and body systems rapidly fail, without an adequate

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exchange of oxygen and carbon dioxide (Van Soom, 2024). When oxygenation and ventilation are inadequate Continuous Positive Airway Pressure is needed. Continuous Positive Airway Pressure refers to the application of positive pressure to the airway of a spontaneously breathing neonate throughout the respiratory cycle. It is a means of providing respiratory support to neonates with either upper airway obstruction or respiratory failure (Lavizzari et al., 2023; Lynch et al., 2024).

Respiratory failure constitutes either failure of ventilation or failure of lung function. It delivers oxygen concentrations and distending airway pressures via the ventilator without the hazards associated with full endotracheal intubation and mechanical ventilation. Delivery of constant positive pressure to the airway of a spontaneously breathing neonate maintains adequate functional residual capacity within the alveoli to prevent atelectasis and improves oxygen and carbon dioxide exchange within the pulmonary circulation (Davies et al., 2024; Yamashiro & Iyer, 2024).

Continuous Positive Airway Pressure machine delivers a constant flow of air through tubing and into neonatal airway. It creates enough pressure in neonatal airway to hold the tissue open, so there airway doesn't collapse. The soft, steady jet of air from the CPAP machine creates enough pressure to keep the airway open (Bizzotto et al., 2024; Hamid et al., 2024).

CPAP is providing respiratory support to neonates have either upper airway obstruction or respiratory failure. The respiratory failure means failure of ventilation or failure of lung function. CPAP delivers oxygen concentrations and distending airway pressures via the ventilator without the hazards associated with full endotracheal intubation and mechanical ventilation. CPAP maintain adequate oxygen in alveoli to prevent atelactasis and improve oxygen and carbon dioxide exchange within the pulmonary circulation that enhance neonate' breathing (Badamasi et al., 2024; Wheeler & Smallwood, 2020).

Complications of CPAP in preterm neonates which result from the fixation devices include; nasal tube when it didn't fit the nostrils, resulting in gas leak and inability to maintain a baseline pressure (Guimarães et al., 2020). Moreover, the set CPAP level is rarely maintained in the pharynx. It may also include nasal leaks because the nasal tube fits loosely in the nostrils and nasal trauma which considered a common problem with CPAP. It also include increasing O2 requirement or episodes of desaturation and apnea, excessive bradycardia with movement, excessive nasal irritation, significant apnea or increasing respiratory acidosis or O2 requirement of 80-100% (Guimarães et al., 2020; Massa-Buck et al., 2023).

The nurse should be aware of the complication of CPAP and take in consideration all necessary precaution to achieve infant safety. Assess frequently any abnormalities to avoid pneumothorax. The risk of nasal trauma can be minimized by adherence to the recommended fixation technique and close observation. To avoid distension by placement of an oro-gastric tube, aspirate air prior to each feed (Helal et al., 2022; Mariam & Buddhavarapu, 2020).

Moreover, nurse should be checked auxiliary temperature least 4 hourly, application of skin probe to continuously monitor temperature, changes in the infant's condition including

Response to handling, changes to skin integrity, administration of medications, fluid balance, procedures and investigations and parental interaction should be documented. Always maintain optimal humidity for the inspired gases to facilitate mucociliary action, clear secretions optimize gas exchange and minimize the risk of infection, if suction is required the color, consistency, and quantity of secretions should be recorded (Dada et al., 2021; Sivanandan & Sankar, 2020; Soliman, 2023). Despite the growing body of research on the utilization of Continuous Positive Airway Pressure (CPAP) in neonatal care, there remains a significant research gap concerning the impact of structured teaching programs on the knowledge and practice of nurses in this context. Therefore, the purpose of this study is to evaluate the effect of structured teaching program on knowledge and practice of nurses about the care of Continues Positive Airway Pressure (CPAP) therapy in neonates.

Methodology

A quasi-experimental pre-post research design was chosen to determine the effectiveness of a properly planned teaching program on the knowledge and

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practice of nurses in relation to the care of neonates on Continuous Positive Airway Pressure (CPAP) therapy. To determine the knowledge and level of practice changes, the study was carried out in an interval of before the intervention and directly after.

The research was carried out in the Neonatal Intensive Care Unit (NICU) of Children Hospital, Lahore, Pakistan. The participants were registered nurses who were engaged in full-time employment in the NICU with ages between 23-45 years and six months or more clinical experience. Student nurses were excluded as well as head nurses and any other person who had undergone previous training involving CPAP in the last six months. Purposive sampling was employed to select participants. The original sample size was computed to provide a statistical power, and 20 % margin of error was added to allow space for possible dropouts and which makes a figure of 50 subjects.

Data Collection Procedure

The data collection tools included:

1.A self-completed questionnaire that contained three parts, socio-demographics, knowledge on the CPAP treatment, and the practice of nurses on the CPAP.

2.A standardized instrument to determine the knowledge that was borrowed based on existing validated questionnaires.

3.They are structured observation checklists which were administered as part of assessment of the practices of nurses before, during, and after CPAP therapy.

The knowledge questionnaire comprised 38 items across six sections. Answers were awarded 1, 0 was given to incorrect answers and unknown answers. Knowledge levels would be grouped into poor (less than 60 %), average (60 -74 %), and good (more than 75 %) knowledge levels. There were 35 items on the practice checklist in three stages of the procedure. All the items were graded on a 3-point scale: 2-completely done, 1-partially done, and 0-nothing done. The practice scores were classified to be labeled as competent (at least 80%) and incompetent (below 80%).

Intervention Process

The intervention was executed in four phases:

1. Phase of Assessment (Pre-Test): The aforementioned tools were used in collecting baseline data of the knowledge and practice.
2. Program Development: Using the assessment and literature review, it was constructed to have a structured program teaching program with theoretical and practical elements of CPAP care.
3. Implementation: It was trained during three months and 6 classes (3 theory; 3 practice). The sessions were interactive and various techniques were employed including lectures, discussions, demonstrations, and role-plays.
4. Post-Test Evidence: The retest on the same tools was used to measure the gains.

Data Analysis Procedure

Data were analyzed using SPSS Version 24. Socio-demographic/outcome statistics were provided as descriptive data (mean, frequency, standard deviation). To compare the knowledge and practice scores, paired sample t-tests were used to make comparisons between pre-intervention scores and post-intervention scores. Chi-square tests were employed for categorical variables. To determine the internal consistency of the instruments, Cronbach alpha was used and it provided a score of 0.72 in knowledge and 0.89 in practice, which means that it is also good.

Results and Analysis

Demographic characteristics of participants

The study sample consisted of 50 nurses, with 76% being female and all employed permanently as charge nurses at Children Hospital Lahore's Neonatal Intensive Care Unit. Most participants (66%) were aged between 35–45 years, and 58% held a nursing diploma, while 20% had a master's degree. A majority were single (54%), and their professional experience ranged from 1 to over 10 years. Notably, 30% had 7–10 years of experience, indicating a relatively seasoned workforce (Table 1).

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Table 1: Demographic Profile of Participants

Variable	Category	Frequency	Percentage
Gender	Male	12	24.0
	Female	38	76.0
Job Type	Permanent	50	100.0
Marital Status	Married	23	46.0
	Single	27	54.0
Age Group	23-34 Years	17	34.0
	35-45 Years	33	66.0
Qualification	Nursing Diploma	29	58.0
	Specialty	11	22.0
	Masters	10	20.0
Job Position	Charge Nurse	50	100.0
DHQ Location	Children Hospital Lahore	50	100.0
Department	Neonatal Intensive Care Unit	50	100.0
Experience	1-3 Years	13	26.0
	4-6 Years	13	26.0
	7-10 Years	15	30.0
	Above 10 Years	9	18.0

The paired sample t-test results comparing pre- and post-intervention knowledge and practice scores among nurses. The mean difference in knowledge was 0.314 with a highly significant p-value of 0.000, indicating substantial improvement. Similarly, the practice scores improved by a mean difference of 0.324, also statistically significant (p = 0.000). These findings confirm the effectiveness of the structured teaching program in enhancing both theoretical understanding and clinical competence (Table 2).

Table 2: Comparative Analysis of the Knowledge and Practices in Pre and Post-Educational Intervention Nurses' Practice

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	K_Pre - K_Post	.314	.141	.020	.274	.354	15.782	49	.000
Pair 2	Pract_Pre - Pract_Post	.324	.197	.028	.268	.380	11.645	49	.000

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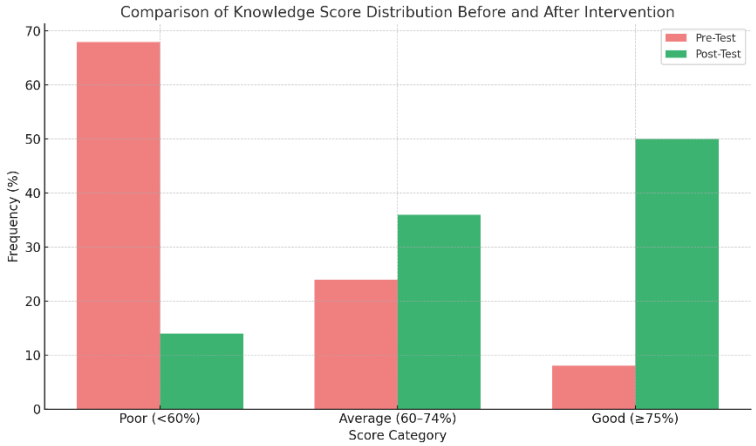

Figure 1: Pre- and Post-Test Knowledge Score Distribution Among Nurses

The figure 1 illustrates a significant improvement in nurses' knowledge scores post-intervention, with a sharp decline in the "Poor" category and a substantial rise in the "Good" category. This demonstrates the effectiveness of the structured teaching program.

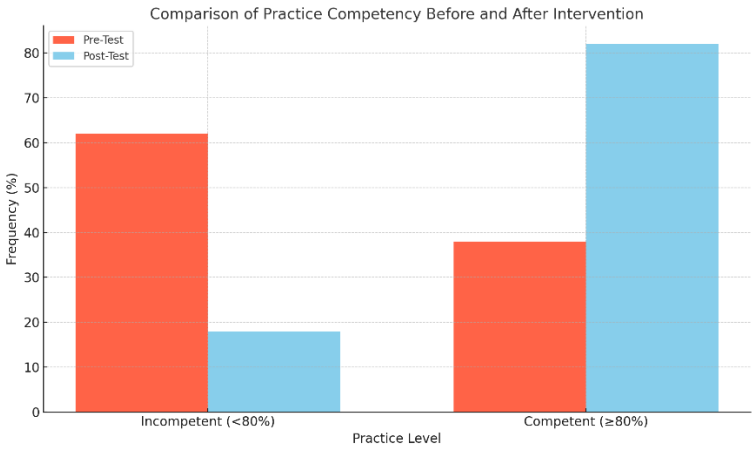

Figure 2: Pre- and Post-Test Practice Competency Classification

The figure 2 illustrates a sharp increase in the percentage of nurses classified as "Competent" after the intervention, rising from 38% to 82%. This highlights the effectiveness of the structured teaching program in improving practical skills related to CPAP care.

Discussion

Continuous Positive Airway Pressure (CPAP) refers to a non-invasive method for application of constant distending pressure level in duration of inhalation and exhalation to provide assistance spontaneously breathing newborn infants with lung disease. It is widely used approach and denoted as "open-lung approach" primarily utilized for management infant disposition of development airway instability, edema, and atelectasis as well (DiBlasi, 2009). Further, it is widely used approach in infants with acute respiratory failure with the aim to correct hypoxemia. It allows the healthcare professionals such as nurses to permit a higher inspired oxygen content that other methods used for the oxygen supplementation. It helps to increase the airway pressure, consequently improves the ventilation to collapsed areas of the lung (Aziz & Abdul-Hamza, 2017).

Further, Lomnyack et al. (2020) stated that CPAP is provision of the air pressures that helps to maintain the patency of the airway in patients with a variety of

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the breathing issues. Nurses are the main frontline workers who provide hour to hour management of patients who require CPAP. And it is required that the knowledge gaps among healthcare professionals such as nurses should be addressed (Lomnyack et al., 2020). Notably if patients are provided with appropriate CPAP, then there may be some potential negative outcomes and treatment delays because of this knowledge gap. For this purpose, healthcare institutes may spend a good amount of financial resources to further advance the critical care, it could positively impact the healthcare delivery. Primarily nurses are responsible for the CPAP settings and neonate's response including oxygen, respiratory rate, and discomfort sign if there is any. Therefore, this study argues that with the right knowledge and practicing skills nurses may detect the afore-mentioned issues in neonates and help save the lives with timely and effective CPAP interventions. Accordingly, this study examines the influence of the structured teaching programs on knowledge and practices among nurses related to the CPAP particularly in context of neonates.

Pre-Intervention knowledge and practices Assessment

The pre-intervention data highlights that nurses may have severe knowledge gaps with respect to CPAP knowledge and practices that's not unique to this study settings. Globally studies have identified that nurses have limited knowledge with respect to CPAP therapy. For example, Lomnyack et al. (2020) in their study identified that only 38% of nurses reported to have higher level of knowledge regarding the CPAP. It affirms that a limited information is available with nurses particularly for the general information of CPAP. Similarly, this study findings have revealed that a limited number of nurses which is less than a half were able to demonstrate correct information about the CPAP. Dawoud Mostafa, Bahgat and Dawood (2023) also identified that nurses only tend to remember the questions related to their clinical practices and less focused on the theoretical understanding which means there is a knowledge gap that needs to be addressed. As Damschroder et al. (2022) highlighted that higher numbers in knowledge gaps are important, they are more than just numbers; they are lost chances for prompt intervention.

In pre-intervention data collection participants were asked to rate about their knowledge regarding the aims of using CPAP, uses of CPAP devices for premature babies, and newborns, contraindications to use CPAP devices, and complications related to it as well. However, the data collection revealed a limited understanding among nurses in this regard. For example, only 40% of them were able to correctly identify the aims of using CPAP device. This indicates that a majority 60% of nurses lacked a clear understanding of primary purpose of using CPAP device. The lower percentage in this area recommends the limited exposure to these devices, training and poor clinical understanding about the purpose. A previous study has also identified that a large number of nurses are not informed about the basic aim of using CPAP devices (Dawoud Mostafa, Bahgat, & Dawood, 2023). Notably, a good educational intervention can potentially advance the level of understanding (Levy, Evans, & Rhodes, 2018).

Limited knowledge persisted in terms of correct identification of CPAP among study participants. The consistent limited knowledge regarding the CPAP device uses among study participants poses a serious implication to patient care. Particularly, it is critical in clinical settings where accurate utilization of CPAP device is important for management of patients with "respiratory distress, obstructive sleep apnea, or other pulmonary conditions". For example, Jeppesen et al. (2025) identified that high adherence of CPAP treatment is for more than 4 hours/night whereas low adherence is for less than 4 hours/night. While studies report that 10% to 78% of patients tend to achieve high adherence after initiating CPAP. Thus, a larger number of patients with OSA do not achieve successful CPAP treatment. It reflects that limited knowledge about uses of CPAP results in less effectiveness. It hints at the need of some sort of training that can add to the knowledge among the nurses.

Further, CPAP is widely used to provide care to support infants with certain issues such as respiratory distress. However, it also comes with some limitations and they should be identified by the healthcare professionals especially nurses. There is

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need to rightly identify the contraindications including congenital anomalies such as cleft palate or choanal atresia etc. identification of these contraindications is important to avoid life-threatening complications. However, this study in pre-intervention data collection revealed that nurses have limited understanding about the contraindications related to CPAP devices. Therefore, healthcare professionals in neonatal must be well-informed about contraindications of CPAP and its safe usage conditions as well (Klingenberg et al., 2017).

Additionally, this study also tested for the practices before, during and after practices related to connecting neonate with the CPAP. However, a larger number of nurses did not follow the protocols and several practices at all these levels are missed. For example, 64% of nurses reported not to prepare suction machine before connecting neonate to the CPAP. This may be due to limited infrastructure at low-resources settings. As indicated by Carns et al. (2022), early continuous positive airway pressure (CPAP) is recommended for neonates <30 weeks gestational age but CPAP is often not available in low-resource settings. Thus, possibly due to limited infrastructure few practices among nurses may not be followed.

The findings above reported that nurses have limited understanding and there are practices gaps in using CPAP or in other words, all measures of using CPAP are not being followed by them. However, this critical situation can be dealt with providing trainings, workshops, case-based discussions and online learning to enhance their knowledge in identified area (Chalwin et al., 2020).

Post-Intervention knowledge and practices Assessment

The study also collected data about the knowledge and practices about CPAP device among the nurses. The post-interventional analysis signifies that majority of the nurses reported a good amount of knowledge about the key aspects of CPAP.

In the post-intervention data analysis, the knowledge of nurses seems to be improved. As majority of the nurses were able to correctly describe about the CPAP fundamentals. For example, they were able to identify that CPAP is effective treatment primarily used for management of conditions such as sleep apnea and respiratory distress. It should be noted that the knowledge about CPAP is of significant importance and helps the nurses to take required actions and decisions while managing the patients with this technique. It helps to improve safety as well (Lomnyack et al., 2020). A majority of nurses (72% to 76%) have correctly answered about the fundamentals of CPAP. It shows that the educational intervention has significantly advances their knowledge in this area.

Degree of knowledge of nurses about the aim of CPAP devices was also tested in post-intervention study. The results indicated that nurses' majority have depicted a better knowledge regarding CPAP aims such that they have correctly identified its use for the prevention of high blood pressure (80%), reduced apnea (76%) and lower upper airway resistance (78%). This shows that the educations intervention has resulted in positive improvement in basic understanding of nurses regarding the aims for which CPAP is used. Dawoud Mostafa, Bahgat and Dawood (2023) also reported that the nurse's knowledge increased regarding CPAP after intervention. Similarly, post-intervention data collection revealed that nurses had better identify the uses of CPAP devices for premature babies and newborns. A very high majority (88%) of nurse have correctly identified that CPAP is used for reduction of need for the tubes in respiratory emergencies. Another good majority (76%) has identified that CPAP is used for apnea treatment among the premature babies. This reflects that higher understanding about use of CPAP would better reflect in their good clinical practice and improved patient care. A previous study (Ali & Abdulwahhab, 2022) highlighted that CPAP aim is to enhance oxygenation, ease breathing, and to avoid the incubation. It can potentially reduce burden on the ICUs. Therefore, good skills and knowledge among nurses is required to minimize risk of potential complications arising due to utilization of CPAP therapy (Aziz & Abdul-Hamza, 2017).

Further, post-intervention data analysis also revealed that nurses obtained a good knowledge about the contraindications of using CPAP devices. It reflects that they have good knowledge about contraindications including "hemodynamic

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instability, impaired consciousness, facial trauma or surgery, excessive secretions, and untreated pneumothorax" (Pinto, Sankari, & Sharma, 2025). Having a good knowledge about when to use CPAP would save patients from worse outcomes such as air leaks, and reduced cardiovascular output as well. Moreover, the data about the practices related to connecting neonatal with CPAP device reveals that nurses has gained more insights and they are following protocols and practices before, during and after connecting neonatal with CPAP. Assessment and application of best practices is recommended when CPAP is administered (Pinto, Sankari, & Sharma, 2025). Overall, findings of the study indicated that providing training was effective tool to increase the knowledge and data analysis have revealed a significant improvement in both knowledge and practices about CPAP. Therefore, these training should be continued at healthcare settings because only a once may not fully serve their purpose and reduce the long-run success.

Comparison of Pre and Post Intervention

This study has demonstrated that how nurses were impacted by the educational intervention. It significantly improved their knowledge and practice, with average improvements of around 0.31 and 0.33. The data show that these changes were undoubtedly not coincidental.

These findings indicate that training among the nurses is vital and proved to improve their knowledge but also their clinical practice regarding CPAP. Further, it helps to accurately apply their knowledge in their daily routine work especially, in domain of critical areas such as CPAP applications. It is likely that the continued trainings provides fresh knowledge to nurses which later on improves their clinical practices. In summary, this study signifies the importance of the targeted and planned training programs to empower nurses by enhancing their knowledge and use of information.

Conclusion

This study has focused and analyzed how knowledge fostered by educational intervention can help nurses improve their understanding and practices about CAPA. Prior to the intervention, there were some significant knowledge gaps such as they were not able to correctly describe the fundamentals of CPAP, there was also less confidence in correctly identifying the uses of CPAP and primary aims for which it is used. Whereas, training among nurses has led to improved knowledge and practices among them and they reported to comply about the practices.

Although, educational intervention has resulted in major improvements but still there are few nurses reported not to have gained much more insights. It reflects that these programs should be continued and organized regularly for betterment of healthcare practices among nurses particularly for those who lacks knowledge about CPAP and are not fully aware about the clinical practices compliance.

Recommendations

In light of the findings of this study, several key recommendations are proposed to enhance the knowledge and practice of nurses providing CPAP therapy in neonatal intensive care units:

1. **Integration of Structured Teaching Programs into Routine Training**

Hospitals and nursing institutions should institutionalize structured CPAP education programs as part of their ongoing professional development curricula. These programs should include both theoretical and practical components, covering device handling, indications, contraindications, and complication management

.

2. **Regular Refresher Courses and Simulation-Based Learning**

Continuous professional education should not be a one-time event. Periodic refresher training and simulation-based workshops must be conducted every 6–12 months to reinforce best practices and keep staff updated with evolving CPAP protocols and technology.

3. **Development of Standard Operating Procedures (SOPs)**

NICUs must develop and implement SOPs and checklists for CPAP therapy. These SOPs should be accessible, clear, and guide nurses step-by-step through the care process before, during, and after CPAP administration.

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4. **Mentorship and Clinical Supervision**
Appointing experienced nurses or respiratory therapists as mentors can provide ongoing guidance and supervision. This ensures compliance with CPAP protocols and encourages reflective practice in real-time scenarios.

5. **Strengthening Institutional Support and Infrastructure**
Hospital management should ensure the availability of CPAP machines, appropriate accessories, and monitoring equipment. Investment in safe staffing levels is also essential to reduce nurse fatigue and increase time per patient, which is critical for CPAP care.

6. **Integration of CPAP Education into Nursing Curriculum**
Nursing colleges and universities should embed CPAP care, including complication management and patient monitoring, into pre-service education to ensure that all graduating nurses are adequately prepared for NICU practice.

7. **Future Research and Multicenter Studies**
Further research should explore long-term outcomes of structured training programs across multiple hospitals and geographic regions to validate the effectiveness and scalability of such interventions in diverse healthcare settings.

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