Journal of Cardiovascular Disease Research
ISSN: 0975-3583,0976-2833 VOL 16, ISSUE 7, 2025

# EFFECTIVENESS OF A STRUCTURED TEACHING PROGRAMME ON KNOWLEDGE OF ENDOTRACHEAL TUBE SUCTIONING AMONG NICU STAFF NURSES: A PRE-EXPERIMENTAL STUDY

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**Abstract:**

Maintaining airway patency is a fundamental and critical aspect of neonatal intensive care, especially in managing neonates who require mechanical ventilation. Among the various interventions used to support respiratory function, endotracheal (ET) tube suctioning holds particular significance in ensuring the removal of accumulated secretions, preventing airway obstruction, and promoting effective gas exchange in intubated newborns. This procedure, though routine, must be performed with precision and adherence to clinical guidelines to avoid adverse outcomes. Improper suctioning techniques—such as incorrect catheter insertion depth, excessive suction pressure, or inadequate pre-oxygenation—can result in serious complications including hypoxemia, mucosal injury, bronchospasm, nosocomial infections, and even increased intracranial pressure. These risks underscore the importance of equipping neonatal nurses with the appropriate knowledge and practical skills required to perform ET tube suctioning safely and effectively. Structured, evidence-based training programs tailored to the NICU setting are therefore essential. They not only enhance the competency and confidence of nursing staff but also contribute to improved patient safety, reduced incidence of suction-related complications, and better overall respiratory outcomes in neonates.

**Objectives:**

This study aimed to (1) assess the pre-test and post-test knowledge regarding ET tube suctioning among NICU staff nurses, (2) evaluate the effectiveness of a structured teaching programmer, and (3) examine the association between pre-test knowledge and selected demographic variables.

**Methods:**

A pre-experimental one-group pre-test post-test design was adopted. A total of 60 NICU staff nurses were selected from a hospital in Kanpur, Uttar Pradesh, using purposive sampling. A self-structured knowledge questionnaire was used as the data collection tool. Descriptive and inferential statistics, including paired t-test and chi-square test, were applied for analysis.

**Results:**

Pre-test scores showed that 10% of the participants had poor knowledge, 18.3% had average knowledge, and 71.7% had good knowledge. Post-test results revealed that 100% of participants attained good knowledge scores. The mean knowledge score increased from 13.9 (SD = 3.6) in the

pre-test to 24.7 (SD = 2.1) in the post-test. The paired t-test value was 7.5, which was highly significant ($p < 0.05$), confirming the effectiveness of the structured teaching programme. Chi-square analysis showed a significant association between pre-test knowledge and previous ET suctioning experience ($\chi^2 = 23.7$, $p < 0.005$), while other demographic variables were not statistically significant.

**Conclusion:**

The structured teaching programmer significantly improved the knowledge of NICU staff nurses regarding ET tube suctioning. Regular in-service education and protocol-based training are recommended to enhance clinical competence and patient safety in neonatal intensive care units.

**Keywords:**

NICU, ET tube suctioning, structured teaching programmer, knowledge, staff nurses, neonatal care, airway management.

## Introduction

Airway management is a cornerstone of neonatal intensive care, with endotracheal (ET) tube suctioning being one of the most frequent and essential nursing interventions to maintain airway patency in intubated neonates. ET suctioning facilitates the removal of secretions from the tracheobronchial tree and ensures effective ventilation and oxygenation, which are vital for survival in critically ill neonates [1]. However, improper techniques may lead to adverse outcomes such as hypoxemia, infection, mucosal trauma, bronchospasm, and increased intracranial pressure [1,2]. These risks emphasize the necessity of training and competence among neonatal nurses who perform this procedure routinely.

The main indications of ET tube suctioning are, excessive secretions, if the Childs oxygen saturation is low i.e. 92% in child without cyanotic heart lesion, any obstruction in the respiratory tract and in the children who are having decreased effectiveness of the cough mechanism. There are some conditions also that can cause over production of mucus like cystic fibrosis, trachea-esophageal fistula before surgery. After ENT and oral surgery child may bleed postoperatively may require ET tube suctioning. However, ET tube suctioning is not a benign procedure; which has associated risks like cardiac dysrhythmias, hypoxemia, atelectasis, bronchospasm, infection, trauma to the mucosal linings and cilia of the airway, and increased intracranial pressure. There may be chance of hypoxia to occur during endotracheal suctioning, when ventilator has been disconnected. The American Association of Respiratory Care (AARC) states that "successful suctioning of an intubated patient improves air exchange and breath sounds, decreases the peak inspiratory pressure, decreases airway resistance, increases dynamic compliance, increases tidal volume delivery when using pressure-limited ventilation which improves arterial blood gas values, improves oxygen saturation, and removes secretions".

The American Association for Respiratory Care (AARC) highlights that proper endotracheal (ET) tube suctioning plays a vital role in maintaining optimal respiratory function. It facilitates effective gas exchange, reduces airway resistance, enhances dynamic lung compliance, and helps stabilize arterial blood gas values and oxygen saturation levels, thereby contributing significantly to the patient's respiratory status and overall clinical stability [3]. ET suctioning is a frequently employed intervention in neonatal intensive care units (NICUs), where timely and appropriate airway management is critical. However, despite its widespread application, research indicates notable inconsistencies in nursing practices related to this procedure. Variations are commonly observed in aspects such as suction depth, the selection of catheter size, the level of suction pressure applied, and the routine use or avoidance of saline instillation. These discrepancies often arise due to a lack of standardized training, absence of clear evidence-based guidelines, or inconsistent institutional protocols [4]. Such variability can potentially compromise the safety and effectiveness of suctioning, underscoring the need for continuous education, training programs, and adherence to best practice standards among NICU healthcare professionals.

Multiple studies underscore the knowledge-practice gap in ET suctioning among nursing professionals. For instance, a descriptive study in Australia revealed that nurses often rely on deteriorating clinical signs rather than standardized protocols to initiate suctioning, indicating a need for structured educational interventions [5]. Another observational study in Spain demonstrated a significant discrepancy between nurses' theoretical knowledge and actual performance during suctioning procedures, reinforcing the importance of formal training [6].

In India, ventilator-associated pneumonia (VAP), frequently attributed to suboptimal suctioning practices, remains a leading cause of neonatal morbidity and mortality. A 2009 study reported VAP rates as high as 37.2% per 1000 ventilator days among neonates, largely involving gram-negative organisms. This reflects the urgent need for evidence-based training programs that equip NICU nurses with essential knowledge and skills to perform ET suctioning safely and effectively.

Hence, this study was designed to evaluate the effectiveness of a structured teaching programme aimed at enhancing the knowledge of NICU staff nurses regarding ET tube suctioning. By bridging the knowledge gap through systematic education, this initiative aims to improve clinical outcomes and patient safety in neonatal critical care settings.

## Materials and Methods

This pre-experimental study employed a one-group pre-test post-test design to evaluate the effectiveness of a structured teaching programmed on knowledge regarding endotracheal (ET) tube suctioning among NICU staff nurses. The study was conducted in the Neonatal Intensive Care Unit of a Yashraj institute of professional studies Kanpur hospital in Kanpur, Uttar Pradesh. A total of 60 staff nurses working in the NICU were selected using non-probability purposive sampling. Inclusion criteria included nurses present during data collection and willing to participate, the

analysis will be done on objectives hypothesis, delimitation to be tested. The analyses of data in planned organize and present under the following.

**Section I:-**Distribution of subjects according to demographic variables using frequency and percentage.

**Section-II: -** Overall analysis of knowledge scores between pre-test and post-test by mean, mean score percentage and SD.

**Section IV:** Analysis of the effectiveness of structured teaching programmer on knowledge regarding ET tube suctioning among NICU staff nurses by using "t" test

**Section V: -** Chi-square analysis to find out association between pre-test knowledge scores with their selected socio-demographic variables.

Data were collected using a self-structured questionnaire comprising two sections: **Section A** collected demographic information (such as age, gender, educational qualification, duration of NICU posting, and prior knowledge), **Figure 1**

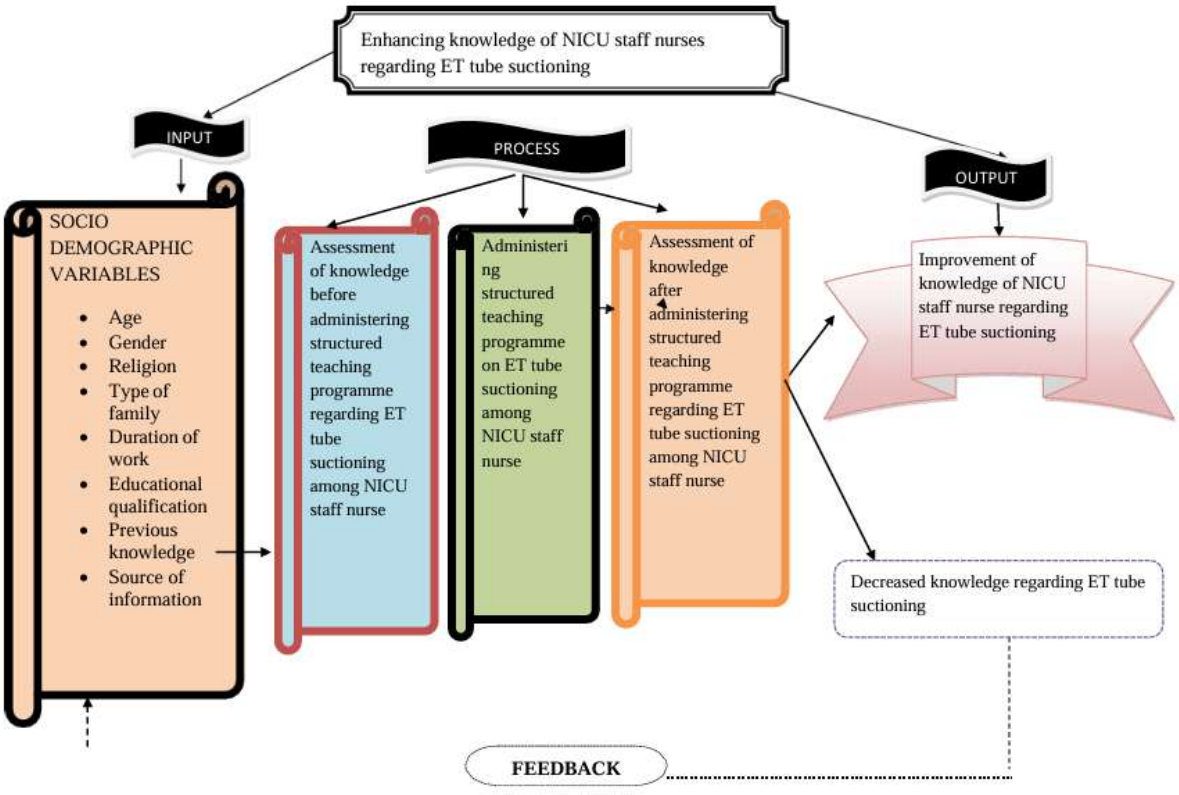



**Figure:1** Enhancing knowledge of NICU Staff in ET Tube Suctioning

**Section B** assessed knowledge on ET tube suctioning through 30 objective items covering definition, indications, equipment, procedures, precautions, and complications. The tool's content validity was established by 10 pediatric nursing experimental. **Figure 2**

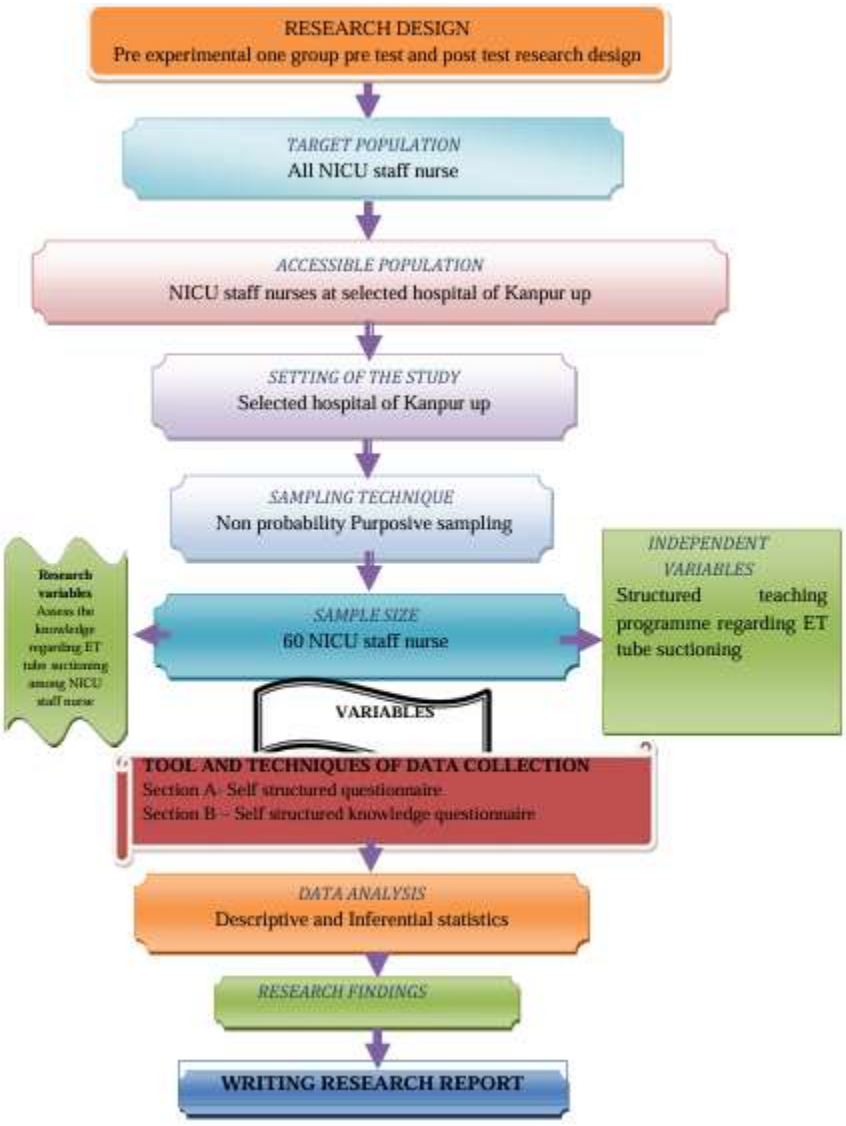



**Figure:2** Pre-experimental One Pretest and Post-test Test research flow

## Result

### Pre-test and Post-test Knowledge Score Distribution

The table number 1 on Pre-Test and Post-Test Knowledge Score Distribution presents a clear picture of the impact of a structured teaching programmer on the knowledge levels of NICU staff nurses regarding endotracheal (ET) tube suctioning. Before the educational intervention, only 43 out of 60 nurses (71.7%) demonstrated good knowledge by scoring in the range of 21–30. However, a significant proportion still showed gaps in understanding, with 11 nurses (18.3%)

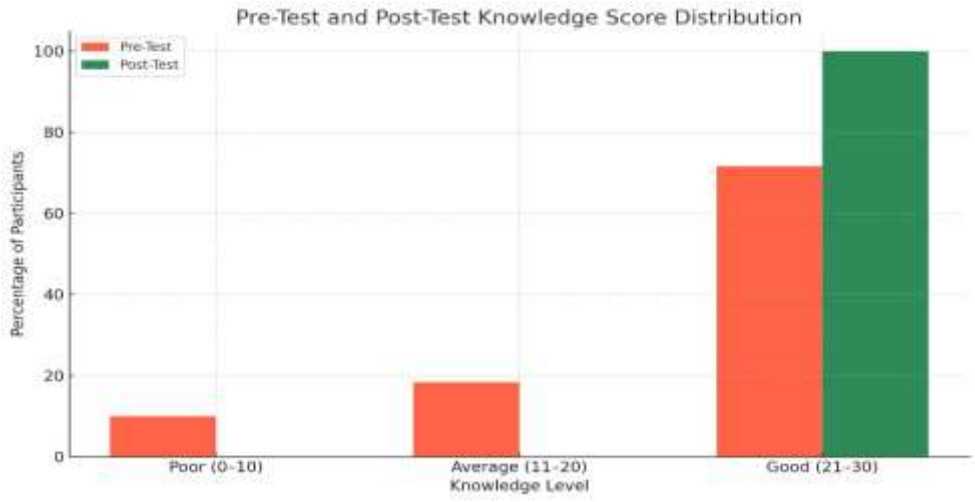
falling into the average category (scores between 11–20), and 6 nurses (10%) classified as having poor knowledge, scoring below 10.

Following the implementation of the structured teaching programmer, the results indicated a substantial improvement. All 60 participants (100%) achieved scores within the good knowledge range during the post-test. Not a single nurse remained in the poor or average knowledge categories, which clearly highlights the effectiveness of the training module.

This transformation from a mixed knowledge baseline to a uniformly high level of understanding suggests that targeted educational interventions can significantly enhance clinical competence among nursing staff. The outcome reinforces the importance of continuous professional development and structured in-service education in high-risk units such as the NICU, where accurate procedures like ET tube suctioning are critical to patient outcomes. It also demonstrates the value of assessing knowledge levels periodically and addressing gaps proactively through evidence-based teaching strategies.

**Table number 1. Showing Pre-test and Post-test Knowledge Score Distribution**

| Knowledge Level | Pre-Test Frequency (%) | Post-Test Frequency (%) |
|---|---|---|
| Poor (0–10) | 6 (10%) | 0 (0%) |
| Average (11–20) | 11 (18.3%) | 0 (0%) |
| Good (21–30) | 43 (71.7%) | 60 (100%) |
| **Total** | **60 (100%)** | **60 (100%)** |




**Bar graph number 1 showing Pre-test and Post-test Knowledge Score Distribution**

**Comparison of Mean Pre-Test and Post-Test Knowledge Scores**

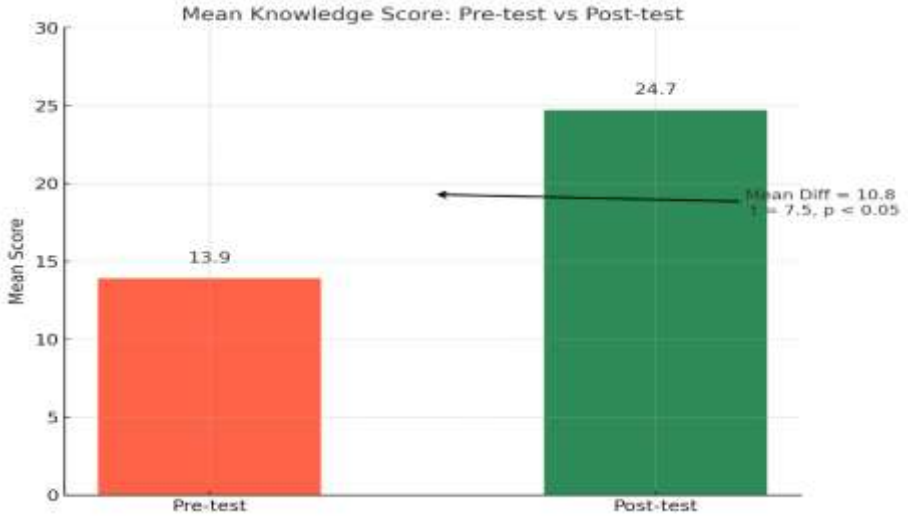
The table number 2 presents a comparison of mean knowledge scores of NICU staff nurses before and after the administration of a structured teaching programmer on endotracheal (ET) tube suctioning. In the pre-test, the participants had a mean score of 13.9 with a standard deviation (SD) of 3.6, indicating a moderate level of knowledge with some variability among nurses. This reflects that although some nurses were relatively aware of ET suctioning procedures, a substantial number lacked adequate understanding.

The post-test showed a marked improvement, with the mean score increasing to 24.7 and a lower standard deviation of 2.1, suggesting that not only did the knowledge level increase significantly, but the responses became more consistent across participants. The mean difference between pre-test and post-test scores was 10.8 points.

Statistical analysis using a paired t-test yielded a t-value of 7.5, which was highly significant at the $p < 0.05$ level. This confirms that the improvement in knowledge after the structured teaching programmer was not due to chance but was a statistically meaningful result. Hence, the intervention was highly effective in enhancing the participants' understanding of ET tube suctioning procedures, supporting the value of regular training programmers for NICU nurses to ensure safe and competent clinical practice.

**Table number 2. Comparison of Mean Pre-Test and Post-Test Knowledge Scores**

| Test | Mean Score | Standard Deviation (SD) | Mean Difference | t-Value | p-Value |
|---|---|---|---|---|---|
| Pre-test | 13.9 | 3.6 | | | |
| Post-test | 24.7 | 2.1 | 10.8 | 7.5 | < 0.05 |




**Bar graphs 2 showing Comparison of Mean Pre-Test and Post-Test Knowledge Scores**

**Association Between Pre-Test Knowledge and Demographic Variables (Chi-Square Test)**

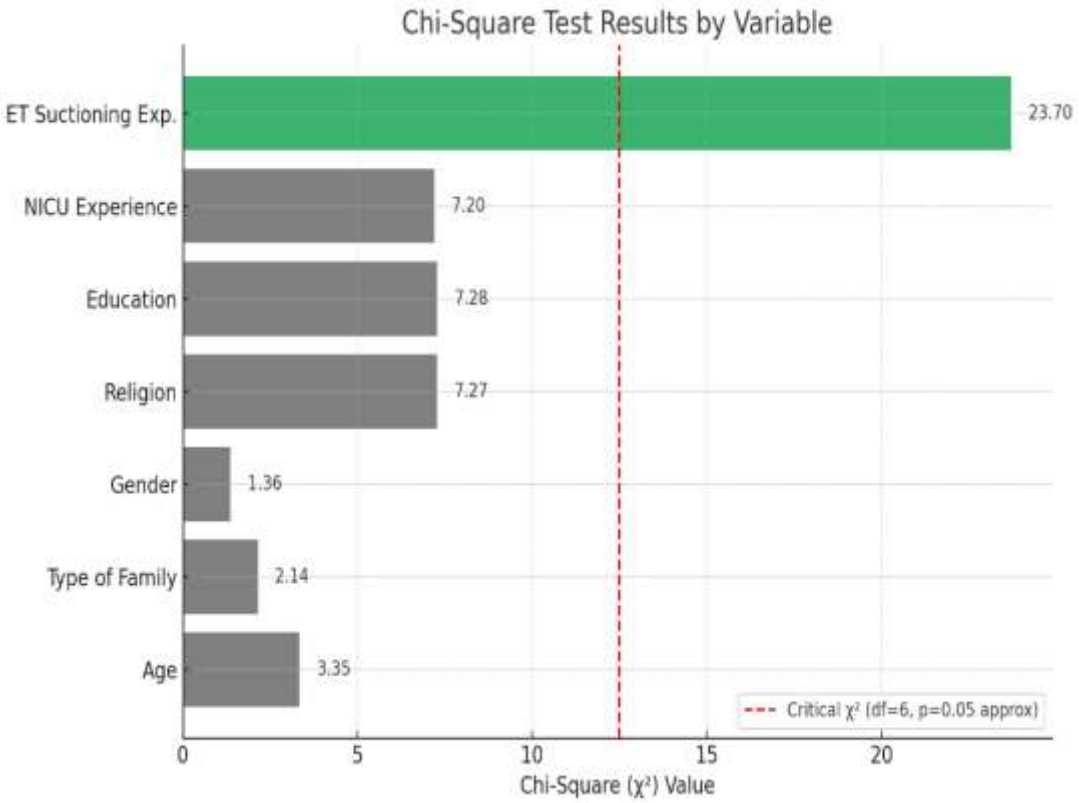
The table number 3 illustrates the results of the Chi-square test used to examine the association between pre-test knowledge scores and various socio-demographic variables of NICU staff nurses. The findings indicate that most variables, including age ($\chi^2 = 3.35$, df = 4), type of family ($\chi^2 = 2.14$, df = 2), gender ($\chi^2 = 1.36$, df = 2), religion ($\chi^2 = 7.27$, df = 6), educational qualification ($\chi^2 = 7.28$, df = 6), and duration of NICU experience ($\chi^2 = 7.2$, df = 6), showed no statistically significant association with the baseline knowledge levels of the participants, as all p-values were greater than 0.05. This suggests that factors such as demographic background, education level, and years of work experience did not significantly influence the nurses' initial understanding of ET tube suctioning.

However, the analysis revealed a statistically significant association between previous experience in ET suctioning and pre-test knowledge scores, with a Chi-square value of 23.7 (df = 6) and a p-value less than 0.005. This indicates that nurses who had prior hands-on experience with ET tube suctioning were significantly more likely to have higher knowledge scores at baseline. This finding emphasizes the importance of practical exposure and experiential learning, suggesting that skill-based practice plays a crucial role in building and retaining critical clinical knowledge among nursing professionals.

In conclusion, while most demographic variables did not influence baseline knowledge, clinical experience with ET suctioning had a meaningful impact, highlighting the value of hands-on opportunities in nurse training and professional development.

**Table number 3. Association Between Pre-Test Knowledge and Demographic Variables**

| **Variable** | **Chi-Square ($\chi^2$)** | **df** | **p-value** | **Significance** |
|---|---|---|---|---|
| Age | 3.35 | 4 | > 0.05 | Not Significant |
| Type of Family | 2.14 | 2 | > 0.05 | Not Significant |
| Gender | 1.36 | 2 | > 0.05 | Not Significant |
| Religion | 7.27 | 6 | > 0.05 | Not Significant |
| Educational Qualification | 7.28 | 6 | > 0.05 | Not Significant |
| Duration of NICU Experience | 7.2 | 6 | > 0.05 | Not Significant |
| **ET Suctioning Experience** | **23.7** | **6** | **< 0.005** | **Statistically Significant** |




**Bar graph number 3 showing Association Between Pre-Test Knowledge and Demographic Variables**

## Discussion

The present study aimed to evaluate the effectiveness of a structured teaching programme on knowledge regarding endotracheal (ET) tube suctioning among NICU staff nurses in a selected hospital at Kanpur. The findings of this study revealed a significant enhancement in knowledge levels following the educational intervention, consistent with the objectives and hypotheses outlined in the study.

### Impact of Structured Teaching on Knowledge

The analysis demonstrated a statistically significant improvement in post-test scores (mean = 24.7, SD = 2.1) compared to pre-test scores (mean = 13.9, SD = 3.6), with a mean difference of 10.8 and a paired t-value of 7.5 ($p < 0.05$). This supports the conclusion that the structured teaching programme was highly effective in improving the nurses' knowledge of ET suctioning. These findings resonate with previous studies conducted both nationally and internationally.

A quasi-experimental study by George et al. (2019) among critical care nurses in India showed a significant improvement in post-intervention scores on ET suctioning knowledge, with a mean difference of 11.2 ($p < 0.001$), validating the efficacy of structured educational modules[7]. Similarly, Sharma and colleagues (2020) emphasized the value of nurse-focused training

programmes in increasing safe suctioning practices, observing a 40% increase in competency scores after training in a tertiary hospital in Delhi [8].

**Comparison with Prior Studies on Knowledge Gaps**

In the pre-test of the current study, 10% of the staff nurses had poor knowledge and 18.3% had average knowledge, reflecting substantial baseline knowledge gaps. These findings are consistent with a Spanish study by Cobo et al. (2020), where the average theoretical knowledge score among nurses was 14.24 but practical competency was lower at 12.09. The study concluded that without structured training, a knowledge-practice gap persists in critical care environments[9].

Further, a mixed-method study by Woods et al. (2018) in Australia, involving 104 pediatric ICU nurses, revealed inconsistency in recognizing indications for suctioning. Nurses often relied on subjective signs such as changes in breath sounds rather than clinical guidelines. The study led to the development of an Endotracheal Suction Assessment Tool (ESAT), emphasizing the need for standardized protocols and education [10].

**Effect of Demographic Factors and Clinical Experience**

Chi-square analysis in the present study found no significant association between pre-test knowledge and demographic factors such as age, gender, educational qualification, or years of NICU experience. However, prior experience with ET suctioning was significantly associated with higher knowledge scores ($\chi^2 = 23.7$, $p < 0.005$). This highlights the crucial role of clinical exposure in skill retention and knowledge application.

This finding is supported by Park et al. (2019) in a Korean study, where nurses with actual hands-on suctioning experience had more stable patient outcomes and demonstrated better understanding of oxygen desaturation risks during suctioning [11]. Moreover, a UK-based study by Royal Liverpool Children's NHS Trust identified improper suctioning as a cause of upper lobe collapse, recommending that prior experience and education are critical to safe practice [12].

**Consistency with Evidence-Based Practice Guidelines**

The American Association for Respiratory Care (AARC) recommends that endotracheal suctioning should be evidence-guided, with proper preoxygenation, use of sterile techniques, and assessment of clinical indications to minimize complications such as hypoxemia, mucosal injury, and infection [13]. In the present study, knowledge scores post-intervention reflected understanding of such principles, with all nurses achieving a “good” knowledge category after the structured session.

In contrast, a US-based national survey by Walsh and Glass (2019) indicated that over 70% of nurses used subjective assessments for deciding suctioning frequency, with limited knowledge of closed-system suctioning benefits. The authors stressed the importance of continuous training to ensure best practice adherence [14].

**Structured Training vs. Routine Practice**

Nurses in high-risk areas like NICU frequently perform ET suctioning as a routine task, often without reflective practice or updates on new guidelines. In the present study, the post-test uniform improvement suggests that structured educational interventions help move beyond routine habits to more conscious, safe, and standardized practices.

A randomized trial in Singapore comparing closed vs. open suctioning techniques among neonates found that nurses trained with structured suctioning modules caused less oxygen desaturation and bradycardia in neonates compared to those with only informal training [15]. This underscores how structured training not only improves knowledge but also directly contributes to patient safety.

**Implications for Nursing Practice and Education**

The study findings have important implications. First, continuous in-service education must be mandatory in NICU units to ensure that all staff possess up-to-date knowledge and skills for safe ET suctioning. Second, simulation-based learning and periodic evaluations should be incorporated into clinical training. Third, the positive correlation between practical exposure and knowledge suggests that training should include hands-on practice, not just theoretical modules.

The conceptual framework of the present study, based on the General Systems Theory, was effectively demonstrated: the structured teaching (input) led to measurable improvement in knowledge (output), with feedback supporting reinforcement of in-service training.

**Conclusion**

The findings of the present study clearly establish that a structured teaching programme significantly enhances the knowledge of NICU staff nurses regarding endotracheal (ET) tube suctioning. The pre-test scores revealed substantial knowledge deficits, with a notable portion of participants falling into the average and poor knowledge categories. However, following the educational intervention, all 60 participants achieved “good” knowledge scores in the post-test, demonstrating not only a statistically significant improvement but also a uniform elevation in understanding across the cohort.

The study further identified that while demographic factors such as age, gender, education, and duration of NICU experience did not significantly influence baseline knowledge, prior experience with ET suctioning was positively associated with higher pre-test scores. This underlines the importance of integrating hands-on practice with theoretical instruction to enhance competency.

The outcomes reinforce existing literature that emphasizes the role of continuous, structured, and evidence-based education in developing and maintaining critical clinical skills. Given the high-risk nature of ET suctioning in neonatal intensive care settings, where even minor errors can result in serious complications, it is imperative that all nursing staff receive ongoing, standardized training.

## References

1. Singh R, Gupta N, Sharma P. Complications of endotracheal suctioning in neonates: a clinical overview. Indian J Pediatr Nurs. 2019;11(2):56–60.
2. American Association for Respiratory Care. AARC Clinical Practice Guidelines: Endotracheal suctioning of mechanically ventilated patients with artificial airways. Respir Care. 2010;55(6):758–64.
3. Kim H, Lee J, Park Y. Comparison of shallow and deep endotracheal suctioning in high-risk neonates: A randomized controlled trial. J Korean Acad Nurs. 2018;48(3):273–82.
4. Gilbert M. Assessment of the need for endotracheal suction in pediatric intensive care: A qualitative study. Paediatr Crit Care Med. 2017;18(1):e32–8.
5. González-Gil MT, Martín-Gil B, Fernández-García E. Knowledge and performance of endotracheal suctioning among nurses in a Spanish hospital. Nurse Educ Pract. 2020;44:102740.
6. Karthikeyan M, Nair M. Ventilator-associated pneumonia in neonates: incidence and risk factors in an Indian tertiary care hospital. Indian J Pediatr. 2010;77(5):437–9.
7. George M, Nair S. Effectiveness of structured teaching programme on knowledge regarding endotracheal suctioning among staff nurses. *Int J Nurs Educ Res*. 2019;7(2):150–4.
8. Sharma A, Singh S, Pathak A. Impact of an educational intervention on knowledge and practice of endotracheal suctioning among critical care nurses. *Nurs J India*. 2020;111(4):189–93.
9. Cobo B, Navarro G, Ruiz D. Evaluation of nurses' knowledge and practices in endotracheal suctioning in University Navarra. *Nurs Crit Care*. 2020;25(3):135–141.
10. Woods C, Thomas A. Development of an evidence-based Endotracheal Suction Assessment Tool: A mixed-method study. *Australas Crit Care*. 2018;31(4):219–225.
11. Park KY, Oh H. Effects of catheter length on oxygen saturation and heart rate during endotracheal suctioning in high-risk infants. *J Korean Acad Nurs*. 2019;49(2):215–223.
12. Royal Liverpool Children's NHS Trust. Clinical audit report: Right upper lobe collapse due to improper suctioning in ventilated neonates. *Pediatr Crit Care Med*. 2018;19(1):67–72.
13. American Association for Respiratory Care (AARC). Clinical Practice Guidelines: Endotracheal suctioning of mechanically ventilated patients. *Respir Care*. 2010;55(6):758–764.
14. Walsh B, Glass C. Current suctioning practices in pediatric intensive care units: A national survey. *Am J Crit Care*. 2019;28(6):474–480.
15. Lee JY, Chan M, Tan JW. Effects of structured training on ET suctioning-related complications in neonates: A randomized trial. *Singapore Med J*. 2020;61(5):260–266.