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# Knowledge, Attitude, and Practice of Artificial Airway Suctioning among Nursing Interns in Intensive Care Units of Tertiary Care Hospitals in Peshawar, Pakistan

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## ABSTRACT

**Background:** Artificial airway suctioning is a fundamental procedure in intensive care units (ICUs), essential for maintaining airway patency, preventing pulmonary complications, and improving oxygenation. However, improper suctioning technique can lead to adverse outcomes such as hypoxia, mucosal injury, infection, and cardiac arrhythmias. Despite established evidence-based guidelines, global studies consistently report inadequate knowledge and poor adherence to recommended suctioning practices among nurses. Limited research in Pakistan has highlighted substantial gaps in theoretical understanding, clinical execution, and attitudinal readiness, particularly among nursing interns who represent the frontline workforce in critical care settings. **Objective:** This study aimed to assess the knowledge, attitude, and practice (KAP) of artificial airway suctioning among nursing interns in tertiary care ICUs in Peshawar, Pakistan, and to examine associations with demographic factors and interrelationships among KAP domains. **Methods:** A cross-sectional descriptive study was conducted from February to August 2024 in ICUs of three tertiary hospitals. A total of 117 nursing interns were recruited via convenience sampling. Data were collected using a validated self-administered questionnaire assessing knowledge (15 items), attitude (10 Likert-scale items), and self-reported practice (10 items). Descriptive statistics, Chi-square tests, and Pearson correlation analyses were performed to explore associations and relationships among variables. **Results:** The mean knowledge score was  $9.86 \pm 2.03$ , with 41% demonstrating good knowledge. Positive attitudes were reported by 42.7%, and 42.7% showed good practice. Formal training was significantly associated with higher knowledge ( $p = 0.002$ ) and better practice ( $p = 0.001$ ), while longer internship duration correlated with improved knowledge ( $p = 0.035$ ). Knowledge correlated moderately with practice ( $r = 0.42, p < 0.001$ ) and weakly with attitude ( $r = 0.25, p = 0.010$ ). **Conclusion:** Nursing interns exhibited moderate knowledge and variable practice regarding artificial airway suctioning, with predominantly neutral attitudes. Formal training and clinical exposure significantly improved competency levels. Strengthening curricula, integrating simulation-based learning, and fostering positive attitudes are critical to enhancing clinical performance and patient safety.

## Keywords

Artificial airway suctioning, Endotracheal suctioning, Nursing interns, Knowledge, Attitude, Practice, Intensive care, Pakistan.

## INTRODUCTION

Artificial airway suctioning, defined as the removal of respiratory secretions via an endotracheal or tracheostomy tube, is a cornerstone of critical care nursing practice, aimed at maintaining airway patency, optimizing oxygenation, and preventing pulmonary complications such as atelectasis (1). Despite its routine nature, the procedure carries significant risks when performed incorrectly, including hypoxia, mucosal injury, bronchospasm, cardiac arrhythmia, and infection, all of which can lead to increased morbidity and prolonged hospitalization (2). Over the past two decades, professional bodies have developed evidence-based guidelines outlining safe suctioning practices, such as pre-oxygenation, avoidance of routine saline instillation, appropriate catheter sizing, and limiting suction time to 10–15 seconds (3). Nonetheless, studies across diverse healthcare systems consistently report substantial discrepancies between recommended protocols and actual nursing practices. For example, more than half of critical care nurses in one multicenter study did not pre-oxygenate or perform chest auscultation prior to suctioning (4). Similarly, global investigations have documented common deviations from best practice, including excessive suction pressure, prolonged suction duration, and inadequate monitoring of patient physiology during the procedure (5).

In low- and middle-income countries (LMICs) such as Pakistan, these practice gaps may be further amplified by limited resources, insufficient clinical training, and variable adherence to evidence-based standards. A cross-sectional study in Peshawar found that ICU nurses exhibited mean

knowledge scores near 50%, with only 4.5%–22.7% achieving good knowledge levels (6). Research from Karachi reported that 40% of nurses had poor knowledge, 20% had moderate knowledge, and only 40% demonstrated high knowledge of airway suctioning (7). Another study from Lahore showed that while many nurses possessed adequate knowledge and positive attitudes toward suctioning and tracheostomy care, a considerable proportion remained inadequately prepared, potentially compromising patient safety (8). These findings underscore a critical gap between training and clinical performance and highlight the urgent need to investigate the factors influencing suctioning competence within the local healthcare context.

Nursing interns, representing the newest cohort of healthcare professionals transitioning from classroom learning to bedside care, are particularly vulnerable to such knowledge-practice discrepancies. Their limited clinical experience, combined with the complexity and high-stress environment of intensive care units, may result in procedural uncertainty and reliance on observed practices rather than standardized guidelines (9). Studies have shown that newly graduated nurses often experience heightened anxiety when performing high-risk procedures such as airway suctioning, which may undermine confidence and adherence to evidence-based steps (10). Furthermore, inadequate exposure to suctioning procedures during training and insufficient mentorship during clinical rotations can exacerbate these challenges, leading to inconsistent practice patterns and variable patient outcomes (11).

Despite the critical nature of artificial airway suctioning and its direct impact on patient safety, there is a paucity of research in Pakistan focusing specifically on the knowledge, attitudes, and practices (KAP) of nursing interns—a group that represents the future frontline workforce in intensive care settings. Most existing studies have concentrated on practicing nurses, overlooking the unique educational and experiential challenges faced by interns during their transition into clinical roles. Understanding their current level of competence and identifying the demographic or educational factors associated with KAP outcomes are essential steps toward designing targeted interventions that strengthen clinical training, improve procedural adherence, and reduce preventable complications.

This study, therefore, aims to assess the knowledge, attitudes, and practices regarding artificial airway suctioning among nursing interns working in the intensive care units of tertiary care hospitals in Peshawar, Pakistan. It further seeks to examine the associations between demographic factors and KAP outcomes, as well as the interrelationships among knowledge, attitudes, and practices. By addressing this gap, the study intends to inform curriculum development, guide institutional training strategies, and contribute to the broader objective of enhancing patient safety and quality of care in critical care environments.

## MATERIAL AND METHODS

This cross-sectional observational study was designed to assess the knowledge, attitudes, and practices regarding artificial airway suctioning among nursing interns working in intensive care units (ICUs) of tertiary care hospitals in Peshawar, Pakistan. The study was conducted over a six-month period, from February to August 2024, to capture a representative sample of interns rotating through ICU placements during the academic cycle. The setting included three major tertiary care teaching hospitals—Hayatabad Medical Complex (HMC), Khyber Teaching Hospital (KTH), and Lady Reading Hospital (LRH)—which together serve as primary training sites for nursing students in the region and provide high-acuity care to a diverse patient population requiring mechanical ventilation and airway support.

Eligible participants were nursing interns assigned to ICU rotations during the study period. Inclusion criteria comprised individuals currently completing their internship within the participating hospitals, who had direct patient care responsibilities involving airway management, and who provided informed consent to participate. Interns who were on leave during the data collection period or had not yet commenced ICU rotations were excluded to ensure that all respondents had recent clinical exposure relevant to suctioning procedures. Participants were recruited through convenience sampling, with researchers visiting ICUs during rotation hours and inviting eligible interns to participate voluntarily. Written informed consent was obtained from all participants after a detailed explanation of the study objectives, procedures, and confidentiality measures.

Data collection was conducted using a structured, self-administered questionnaire adapted from previously validated instruments used in similar studies on suctioning practices (12). To ensure content validity and contextual relevance, the questionnaire was reviewed by a panel of critical care nursing experts and piloted with a small group of interns prior to formal data collection. The final version consisted of four sections: demographic data (age, gender, training history, hospital placement, and internship duration), knowledge assessment, attitude measurement, and self-reported practice evaluation. The knowledge section included 15 multiple-choice questions covering evidence-based principles of suctioning, recommended techniques, and complication prevention. Each correct response was awarded one point, yielding a total possible score of 0–15. Attitudes were measured using 10 Likert-scale items (1 = strongly disagree to 5 = strongly agree) assessing perceptions of suctioning importance, confidence, and adherence to guidelines, with a total score range of 10–50. The practice section assessed the frequency with which participants performed 10 recommended suctioning steps (e.g., pre-oxygenation, monitoring vital signs) on a scale from “never” to “always,” with scores ranging from 0 to 10.

For operational categorization, knowledge scores  $\geq 11$  ( $\geq 75\%$ ) were classified as good, 7–10 (50–74%) as moderate, and  $\leq 6$  ( $< 50\%$ ) as poor. Attitude scores  $\geq 41$  ( $\geq 80\%$ ) were considered positive, 34–40 (60–79%) neutral, and  $\leq 33$  ( $< 60\%$ ) negative. Practice scores  $\geq 8$  ( $\geq 80\%$ ) were categorized as good, 5–7 (50–79%) fair, and  $\leq 4$  ( $< 50\%$ ) poor. These thresholds were based on previous KAP studies and established benchmarks in nursing competency research (13). Data collection took place during scheduled ICU shifts, and participants completed the questionnaire independently under supervision to minimize discussion or influence from peers. All responses were anonymized to encourage honesty and reduce social desirability bias.

To address potential sources of bias, the study incorporated several measures. The questionnaire was piloted to refine ambiguous items and improve reliability. Participants were assured that their responses would remain confidential and would not influence academic evaluations. Self-reported practice data were interpreted with caution, acknowledging possible overreporting. Additionally, by including interns from three different tertiary hospitals, institutional bias was minimized, and findings were made more generalizable across clinical settings in Peshawar.

Data were entered and analyzed using Microsoft Excel version 16.91 and cross-validated for accuracy by two independent researchers. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize demographic data and KAP scores. Categorical variables were compared using Chi-square tests to assess associations between demographic factors (age, gender, training, hospital placement, internship duration) and KAP outcomes. Pearson’s correlation coefficient was calculated to explore relationships between knowledge,

attitude, and practice scores. A significance level of  $p < 0.05$  was considered statistically significant for all analyses. Missing data were minimal due to on-site supervision during questionnaire completion; any incomplete questionnaires were excluded from analysis to maintain data integrity. The sample size of 117 participants was determined based on the total number of nursing interns rotating through ICUs during the study period, ensuring adequate representation of the target population. Ethical approval was obtained from the institutional review boards of all three participating hospitals prior to data collection. The study adhered to the principles of the Declaration of Helsinki, ensuring participant confidentiality, voluntary participation, and the right to withdraw at any stage without penalty. All study procedures were designed to ensure transparency, reproducibility, and methodological rigor, allowing replication in future investigations.

## RESULTS

A total of 117 nursing interns participated in this study, providing a comprehensive representation of the cohort working in intensive care units across three tertiary hospitals in Peshawar. As shown in Table 1, the majority of participants (46.2%) were aged between 23 and 24 years, while 39.3% were aged 21–22 and 14.5% were 25 years or older, indicating a predominantly young workforce at the beginning of their professional careers. Female interns comprised 64.1% of the sample, reflecting the gender distribution commonly observed in nursing education. In terms of institutional placement, 37.6% of interns were based at Hayatabad Medical Complex, 33.3% at Khyber Teaching Hospital, and 29.1% at Lady Reading Hospital. Notably, 62.4% had received formal training in airway suctioning, and internship duration was nearly evenly split between those with less than six months (51.3%) and those with six months or more of experience (48.7%).

The overall knowledge level of participants was moderate, with a mean score of  $9.86 \pm 2.03$  out of 15 (Table 2). When categorized, 41.0% of interns demonstrated good knowledge, 47.0% had moderate knowledge, and 12.0% exhibited poor knowledge. This distribution shows that while a substantial portion had achieved a satisfactory understanding of airway suctioning principles, more than half of the participants still fell below the threshold for optimal knowledge, indicating a persistent educational gap. The mean attitude score was  $38.58 \pm 3.44$  out of 50, with 42.7% of participants reporting a positive attitude, 54.7% showing a neutral attitude, and only 2.6% expressing a negative attitude. This suggests that although most interns did not hold unfavorable views toward suctioning, many lacked strong positive perceptions, which could influence their adherence to best practices. Regarding clinical practice, the mean score was  $7.17 \pm 1.45$  out of 10. Good practice was reported by 42.7% of interns, fair practice by 54.7%, and poor practice by 2.6%, indicating that while performance was generally acceptable, a considerable number of interns were not consistently meeting evidence-based standards.

Analysis of associations between demographic characteristics and KAP outcomes revealed several statistically significant relationships (Table 3). Suctioning training was strongly associated with higher knowledge ( $p = 0.002$ ) and better practice ( $p = 0.001$ ), underscoring the importance of structured educational interventions. Internship duration was also significantly associated with knowledge ( $p = 0.035$ ), suggesting that increased clinical exposure enhances theoretical understanding over time. Gender showed a significant association with attitude ( $p = 0.015$ ), indicating that male and female interns differed in their perceptions toward suctioning, though no gender-based differences were observed for knowledge or practice. Age and hospital placement were not significantly related to any KAP outcomes, suggesting that these factors do not substantially influence competency in airway suctioning.

**Table 1. Demographic Characteristics of Nursing Interns (N = 117)**

Variable	Category	n (%)
Age (years)	21–22	46 (39.3)
	23–24	54 (46.2)
	≥25	17 (14.5)
Gender	Male	42 (35.9)
	Female	75 (64.1)
Hospital Placement	HMC	44 (37.6)
	KTH	39 (33.3)
	LRH	34 (29.1)
Received Suctioning Training	Yes	73 (62.4)
	No	44 (37.6)
Internship Duration	<6 months	60 (51.3)
	≥6 months	57 (48.7)

**Table 2. Knowledge, Attitude, and Practice (KAP) Scores Among Nursing Interns (N = 117)**

Domain	Mean ± SD	Category	n (%)
Knowledge (0–15)	9.86 ± 2.03	Poor (≤6)	14 (12.0)
		Moderate (7–10)	55 (47.0)
		Good (≥11)	48 (41.0)
Attitude (10–50)	38.58 ± 3.44	Negative (≤33)	3 (2.6)
		Neutral (34–40)	64 (54.7)
		Positive (≥41)	50 (42.7)
Practice (0–10)	7.17 ± 1.45	Poor (≤4)	3 (2.6)
		Fair (5–7)	64 (54.7)
		Good (≥8)	50 (42.7)

Further subgroup analysis highlighted the impact of training on performance (Table 5). Among interns who had received suctioning training, 54.8% demonstrated good knowledge compared to only 18.2% among those without training ( $p < 0.001$ ). Similarly, 53.4% of trained interns reported good practice, while just 25.0% of untrained interns did so ( $p = 0.001$ ). These results confirm that targeted training significantly improves both theoretical knowledge and procedural competency. Internship duration also influenced mean scores (Table 6), with interns who had completed six months or more achieving higher knowledge scores ( $10.34 \pm 1.88$ ) than those with shorter experience ( $9.42 \pm 2.14$ ;  $p = 0.035$ ), though differences in attitude and practice scores were not statistically significant.

**Table 3. Association Between Demographic Variables and Knowledge, Attitude, and Practice Levels (Chi-Square Analysis)**

Demographic Variable	Knowledge (p-value)	Attitude (p-value)	Practice (p-value)
Age	0.089	0.872	0.142
Gender	0.124	0.015*	0.456
Hospital Placement	0.832	0.901	0.987
Suctioning Training	0.002*	0.784	0.001*
Internship Duration	0.035*	0.550	0.670

\*Statistical significance at  $p < 0.05$ **Table 4. Pearson Correlation Between Knowledge, Attitude, and Practice Scores (N = 117)**

Variables	Knowledge	Attitude	Practice
Knowledge	–	$r = 0.25, p = 0.010$	$r = 0.42, p < 0.001$
Attitude	$r = 0.25, p = 0.010$	–	$r = 0.33, p = 0.002$
Practice	$r = 0.42, p < 0.001$	$r = 0.33, p = 0.002$	–

**Table 5. Distribution of Knowledge and Practice by Suctioning Training (N = 117)**

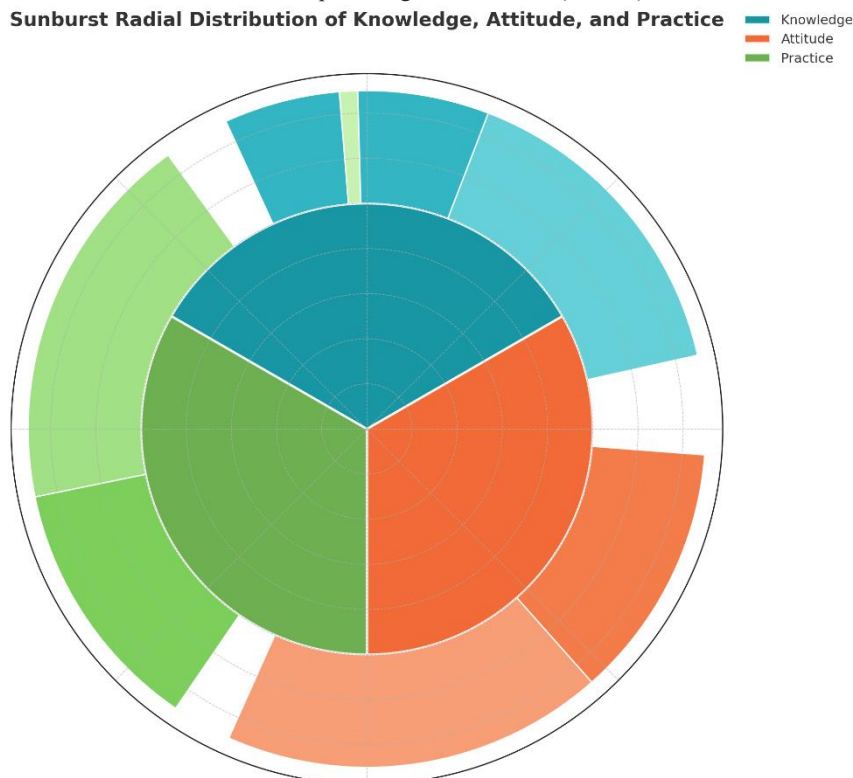
Training Status	Good Knowledge n (%)	Moderate Knowledge n (%)	Poor Knowledge n (%)	Good Practice n (%)	Fair Practice n (%)	Poor Practice n (%)
Trained (n = 73)	40 (54.8)	28 (38.4)	5 (6.8)	39 (53.4)	32 (43.8)	2 (2.7)
Untrained (n = 44)	8 (18.2)	27 (61.4)	9 (20.5)	11 (25.0)	32 (72.7)	1 (2.3)
p-value	<0.001*	–	–	0.001*	–	–

\*Statistical significance at  $p < 0.05$ **Table 6. Mean KAP Scores by Internship Duration**

Duration	Knowledge Mean $\pm$ SD	Attitude Mean $\pm$ SD	Practice Mean $\pm$ SD
<6 months (n = 60)	9.42 $\pm$ 2.14	38.32 $\pm$ 3.28	7.05 $\pm$ 1.52
$\geq 6$ months (n = 57)	10.34 $\pm$ 1.88	38.86 $\pm$ 3.61	7.29 $\pm$ 1.39
p-value	0.035*	0.550	0.670

\*Statistical significance at  $p < 0.05$ 

Correlational analysis further illuminated the interrelationships among KAP domains (Table 4).

**Sunburst Radial Distribution of Knowledge, Attitude, and Practice****Figure 1 Sunburst radial distribution of knowledge, attitude, and practice (KAP) levels among nursing interns in intensive care units.**

Knowledge and practice were moderately correlated ( $r = 0.42, p < 0.001$ ), indicating that interns with greater theoretical understanding were more likely to perform suctioning correctly. Knowledge was also weakly but significantly correlated with attitude ( $r = 0.25, p = 0.010$ ), suggesting that improved knowledge may foster more favorable perceptions. Additionally, attitude and practice demonstrated a moderate positive correlation ( $r = 0.33, p = 0.002$ ), implying that a positive outlook is associated with better clinical performance. Together, these correlations suggest a reinforcing relationship among knowledge, attitude, and practice, where gains in one domain may support improvements in the others.



Figure 1 as shown by sunburst visualization illustrates the hierarchical composition of competency outcomes, offering an integrated view of overall knowledge, attitude, and practice performance. The outer ring represents the three primary domains, each accounting for one-third of the total assessment, while the inner segments depict their respective subcategories. Within the knowledge domain, moderate understanding dominates at 47%, followed by good knowledge at 41% and poor knowledge at 12%. Attitudinal responses are largely neutral (54.7%), with fewer positive (42.7%) and minimal negative (2.6%) perceptions, indicating uncertainty or insufficient confidence in suctioning procedures. Practice patterns mirror this distribution, with fair performance accounting for 54.7% of responses, while 42.7% demonstrate good adherence to recommended techniques and only 2.6% report poor practice. The structure clearly highlights that while foundational competence exists, substantial proportions of interns remain below optimal benchmarks—particularly in the transition from moderate knowledge and neutral attitudes to high-level proficiency and consistent evidence-based practice.

## DISCUSSION

The findings of this study reveal critical insights into the preparedness of nursing interns regarding artificial airway suctioning, a fundamental yet high-risk procedure in intensive care practice. The results indicate that although interns possess a moderate level of knowledge, their attitudes remain largely neutral, and their self-reported practice is often only fair. This knowledge–practice gap, coupled with a less-than-ideal attitudinal disposition, underscores significant deficiencies in current training approaches and clinical preparedness among early-career nurses. These findings align with previous research demonstrating that insufficient knowledge and procedural inconsistencies are widespread among nursing staff across various healthcare contexts (6,7). They also highlight the multifactorial nature of competency development, where theoretical knowledge alone is insufficient to guarantee clinical proficiency (12).

The mean knowledge score of  $9.86 \pm 2.03$  (65.7%) suggests that while interns have a foundational understanding of suctioning principles, substantial gaps remain. Nearly 59% of participants scored in the moderate or poor range, suggesting that core evidence-based practices—such as pre-oxygenation, appropriate catheter sizing, and limiting suction duration—are not universally understood or applied. This is consistent with earlier findings from Peshawar and Karachi, where large proportions of ICU nurses demonstrated inadequate knowledge (6,7). However, the relatively higher percentage of interns achieving good knowledge in this study compared to earlier work may reflect improvements in curricular content or more recent exposure to clinical environments. Prior studies support this observation, showing that structured educational modules and targeted instruction significantly improve theoretical understanding and procedural performance among nursing trainees (13).

Attitudes toward airway suctioning were predominantly neutral, with only 42.7% of interns expressing a positive stance. This is a noteworthy finding, as professional attitudes are a crucial determinant of procedural adherence and patient safety behavior (14). The lack of strongly positive attitudes may stem from limited clinical confidence, anxiety about performing invasive procedures, or inadequate mentorship during training, factors that have been shown to negatively influence student nurses' performance in previous studies (10,11). Interestingly, gender was significantly associated with attitudes ( $p = 0.015$ ), indicating potential socio-cultural or experiential differences in how male and female interns perceive their clinical roles. This contrasts with some previous studies that reported no significant gender-based differences in suctioning competence (6,7), suggesting that attitudinal dynamics may vary depending on institutional culture, teaching methods, or clinical exposure patterns (15,16).

Self-reported practice outcomes also demonstrated variability. While 42.7% of interns achieved good practice scores, a majority (54.7%) reported only fair performance, and a small proportion (2.6%) demonstrated poor adherence. These results highlight the persistence of a theory–practice gap, a phenomenon well-documented in nursing literature where adequate knowledge does not always translate into consistent clinical performance (17). This disparity may be influenced by multiple factors, including limited opportunities for supervised practice, inadequate feedback mechanisms, or institutional resource constraints. Moreover, the reliance on self-reported data may have introduced social desirability bias, potentially leading to overestimation of actual practice quality (17). Observational studies have consistently demonstrated that direct assessment often reveals lower adherence to evidence-based suctioning protocols than self-report surveys suggest (18).

The significant association between formal training and both knowledge ( $p = 0.002$ ) and practice ( $p = 0.001$ ) strongly emphasizes the role of structured education in shaping clinical competence. Participants who received formal training performed substantially better, reinforcing the necessity of embedding comprehensive, simulation-based modules within undergraduate curricula. Additionally, the association between longer internship duration and higher knowledge levels ( $p = 0.035$ ) suggests that experiential learning and repeated clinical exposure are critical to consolidating theoretical knowledge into practical skill. This aligns with previous evidence demonstrating that competence in complex procedures improves significantly with hands-on experience, mentorship, and iterative learning cycles (18).

The moderate correlation between knowledge and practice ( $r = 0.42$ ,  $p < 0.001$ ) underscores the foundational role of knowledge in shaping procedural performance. However, the correlation is not strong enough to imply that knowledge alone is sufficient. Other factors—including confidence, supervision, institutional culture, and workload—likely play substantial roles in influencing practice behaviors. Furthermore, the positive correlation between attitude and practice ( $r = 0.33$ ,  $p = 0.002$ ) suggests that motivational and psychological factors significantly impact adherence to best practices. This reinforces the need for a holistic approach to training that integrates cognitive, affective, and psychomotor learning domains.

Taken together, these findings have important implications for nursing education and clinical practice in Pakistan and similar low- and middle-income settings. The results suggest that curriculum reform should prioritize competency-based learning, integrating theoretical instruction with simulation, supervised clinical practice, and mentorship to bridge the knowledge–practice gap. Moreover, continuous professional development programs and institutional policies promoting evidence-based suctioning protocols could further enhance adherence and patient safety. System-level factors—such as workload, supervision quality, and resource availability—should also be addressed to create supportive environments that facilitate consistent best practices (19).

Overall, this study contributes valuable evidence to the growing body of literature on airway suctioning competencies and highlights critical areas for intervention. By addressing both educational and systemic barriers, healthcare institutions can ensure that nursing interns transition into their professional roles with the knowledge, confidence, and clinical skills necessary to perform artificial airway suctioning safely and effectively, ultimately improving patient outcomes in intensive care settings.

## CONCLUSION

This study demonstrates that while nursing interns in tertiary care intensive care units possess a moderate level of knowledge and show some competency in artificial airway suctioning, significant gaps remain in both attitudes and practical application. Although more than 40% of participants achieved good knowledge and practice levels, the predominance of neutral attitudes and fair performance underscores the need for more comprehensive training strategies. Formal education and longer clinical exposure were shown to have a direct positive impact on knowledge and practice, highlighting the importance of structured curricula, simulation-based learning, and continuous mentorship. The moderate correlations between knowledge, attitude, and practice further suggest that competency development is multidimensional, requiring cognitive, behavioral, and motivational components. Addressing these gaps through targeted educational interventions, standardized clinical protocols, and supportive institutional environments is essential to improving procedural adherence, minimizing patient risks, and enhancing the overall quality of critical care nursing practice.

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