

# Nurses' Confidence and Readiness in Tracheostomy Care and Emergencies: A Cross-Sectional Study

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**Background:** Nurses need proper care skills for tracheostomy care and to handle airway emergencies and prevent complications because nursing preparedness and experience in these situations vary among healthcare facilities which shows that competency evaluations are essential for improving patient safety and care quality.

**Objective:** The study measures nurses' self-assessed proficiency in tracheostomy care management and emergency readiness while pinpointing nursing competency gaps to develop targeted educational and strategic interventions.

**Methods:** A total of 1109 nurses from critical care, surgical, trauma, home care, emergency and outpatient units provided the study data. A structured questionnaire assessed participant confidence levels as well as their knowledge and preparedness, The survey instrument was adapted from a previously validated questionnaire and further reviewed by experts and pilot tested to ensure suitability for the local context. Multiple linear regression and ANOVA, along with *t* test enabled the study to explore the relationships between participants' demographic traits and their educational and workplace experiences in relation to competency levels, this study was reported in accordance with the STROBE guidelines.

**Results:** Female participants comprised 79.1% of the total group, and mean age of  $36.6 \pm 7.4$  years, while most participants came from South Asia (45.9%) followed by Southeast Asia (35.1%) and staff nurses formed 93.4% of the sample with an average professional experience of 12 years, the participants achieved moderate assessment scores measuring confidence at 21.0 out of 30 and knowledge at 8.3 out of 16, nurses from critical care units demonstrated significantly higher levels of both confidence and knowledge registering 23.2 and 9.6 respectively compared to their emergency unit nurses who scored 18.4 and 6.6 and outpatient nurses who scored 19.3 and 5.8 with these differences being statistically significant ( $p < 0.001$ ).

**Conclusion:** The research concludes that nurses require structured training programs combined with practical experience and detailed competency evaluations to improve their tracheostomy care abilities and self-confidence which healthcare organizations should standardize to ensure enhanced patient care results across all clinical settings.

**Keywords:** tracheostomy care, nursing confidence, tracheostomy complications, tracheostomy emergencies, nursing education

## Introduction

Tracheotomy and tracheostomy are surgical procedures that provide airway access for patients who are dependent on prolonged mechanical ventilation and/or frequent suctioning and who require relief of upper airway obstruction. Another definition refers to tracheotomy the surgical incision into the trachea and is used temporarily, while tracheostomy means the insertion of a tube into the trachea to maintain the patient's airway and used permanently, they are often used interchangeably.<sup>1-3</sup>

As critical care technology has progressed, the challenges and complexity of the procedure have also changed. Currently, approximately one-third of patients admitted to the ICU require mechanical ventilation. Among these patients, about one-quarter develop severe lung failure requiring prolonged ventilation, and approximately 10% of those who

survive acute respiratory failure subsequently undergo tracheostomy.<sup>1,4-6</sup> Tracheostomy facilitates ventilator weaning and decreases subglottic secretions in patients unable to maintain airway patency, and bedside staff must be able to manage common and potentially life-threatening emergencies whenever they occur.<sup>7</sup> Two-thirds of tracheostomy cases currently occur in ICUs, reflecting the burden of mechanical ventilation in critically ill patients.<sup>8,9</sup> Consequently, tracheostomy has become common in ICUs as a percutaneous dilatational tracheostomy (PDT), which can be performed at the bedside, saving transport time and reducing complications.<sup>10,11</sup>

Nurses assume a critical role during the tracheostomy procedure, postoperative period, and chronic care. They are responsible for maintaining airway patency, site hygiene, and providing patient and family support and education, and Tracheostomy care is inherently multidisciplinary, requiring close coordination between nurses, physicians, respiratory therapists, and other healthcare professionals, with nurses playing a central role in continuous monitoring and early complication recognition.<sup>10,12,13</sup> Nevertheless, given the complexity of tracheostomy care and the risk of serious complications such as airway obstruction, bleeding, infection, and accidental decannulation, combined with the availability of various tracheostomy tube types and differences in patient acuity and indications, those providing tracheostomy care must continually refine their knowledge and skills to meet diverse patient needs. This underscores the importance of ongoing professional development for health professionals involved in tracheostomy care.<sup>14,15</sup>

Several studies have documented significant heterogeneity in nurses' knowledge, skills, and confidence regarding tracheostomy care, which varies considerably across healthcare settings and regions. Notably, studies on nurses' learning needs have identified potential improvement through targeted educational programs aimed at optimizing nurses' knowledge, attitudes, and clinical practices. For example, studies conducted in Jordan and Saudi Arabia reported moderate knowledge levels and skill gaps, while also demonstrating improvement following structured educational interventions.<sup>12,16</sup>

When tracheostomy care is inadequate, it can lead to complications such as airway obstruction, bleeding, infection, and accidental decannulation, resulting in delayed weaning, increased mortality, prolonged hospitalization, and higher healthcare costs.<sup>17,18</sup> Early postoperative complications, including infections and tube blockages, often result from avoidable nursing care errors and insufficient patient education.<sup>19</sup> In contrast, appropriate tracheostomy care enhances comfort, reduces sedation and injury risk, and shortens hospital stay.<sup>14</sup> Nurses who receive structured education gain confidence in managing emergencies and delivering high-quality care; when this education is supported by regular assessment, care bundles, and multidisciplinary collaboration, patient outcomes improve, complication rates decrease, and patient satisfaction rises.<sup>14,15,18,20-22</sup>

Additionally, evidence from Pritchett et al in pediatric settings demonstrates that structured educational interventions significantly enhance both nursing staff and caregiver confidence in managing tracheostomy care and related emergencies.<sup>23</sup>

Despite growing recognition of the importance of tracheostomy care, there remains limited large-scale evidence assessing nurses' knowledge, confidence, and readiness to manage tracheostomy care and related emergencies across diverse clinical settings within a single healthcare system. Although studies from Jordan and Saudi Arabia have highlighted knowledge gaps and the benefits of focused education,<sup>12,16</sup> no comprehensive evaluation has been conducted to assess the combined knowledge, confidence, and training needs of nurses caring for tracheostomy patients within the present healthcare system. Unlike these regional studies, the present study provides a system-wide assessment across multiple care settings within a single large public healthcare organization, allowing a more integrated evaluation of nurses' confidence, and readiness including knowledge in routine clinical practice. This study aims to address that gap and contribute to the development of evidence-based training programs tailored to local clinical needs.

The aim of this study is to assess nurses' confidence and readiness to manage tracheostomy care and associated emergencies, identify training gaps, and develop strategies to enhance tracheostomy nursing practice. This study targets a defined nursing population, and the findings have important implications for nursing education and patient outcomes.

## Methodology

### Study Design and Sampling

A quantitative, descriptive, cross-sectional research design was used to obtain a broad overview within a defined period and to collect data from a diverse sample of nurses with different levels of experience, specialties, and working settings. This design facilitated the exploration of nurses' knowledge and care practices while managing tracheostomy patients and related emergencies. Similar methodological approaches have been applied in comparable studies in this field.<sup>12,16</sup>

The population consisted of all staff nurses, charge nurses, and head nurses who manage adult tracheostomized patients in critical care, trauma, medical, surgical, long-term, and home care units within a large public healthcare organization. The exclusion criterion was any individual unwilling to participate. A convenience sampling approach was used, and all eligible nurses across the healthcare system who met the inclusion criteria within the targeted population were invited to participate via institutional email. Although an exact response rate could not be calculated, the final sample size and responded nurses was ( $n = 1,109$ ).

### Study Settings

Data were collected using an electronic survey distributed to nurses working across multiple units and facilities within the healthcare system, including critical care, trauma, medical, surgical, long-term, and home care services. The survey was disseminated via institutional Email through the Nursing Workforce and Nursing Research Departments to all eligible nurses within the targeted population. Distribution occurred in phases between January 2024 and July 2024, based on facility categorization and workforce scheduling. The invitation Email included a brief description of the study, institutional ethical approval information, and a secure link to access the online questionnaire hosted on Microsoft Forms. Participation was voluntary, and responses were collected anonymously, with no identifiable personal data recorded. To enhance response rates, a reminder Email was sent two weeks after the initial invitation.

Data collection was conducted over a six-month period (January 2024–July 2024), allowing nurses from different shifts, specialties, and experience levels to participate, thereby ensuring broad representation of the nursing workforce. Survey data were stored on secure, password-protected institutional systems accessible only to the research team.

The study was reported in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist guidelines (see [Supplementary File 1](#)).

### Data Collection Tool

The survey questionnaire was adapted from a previously validated instrument developed by Alotaibi et al,<sup>12</sup> after obtaining formal permission from the original author via email. Content validity of the original tool had been established using the Content Validity Ratio (CVR) formula:

$$CVR = [(E-N/2)/(N/2)],$$

where  $E$  represents the number of experts rating the item as essential and  $N$  the total number of experts. The reported CVR for the original instrument was 0.85, indicating strong content validity.<sup>12</sup>

For the current study, the questionnaire was modified to align with local clinical practices and study objectives. The revised version underwent expert review by four specialists: an ENT physician, an intensive care consultant, a senior nurse educator, and a clinical nurse specialist (see [Supplementary File 2](#)). Modifications primarily involved minor wording adjustments and contextual adaptation to reflect local practice, without altering the original domain structure or scoring framework.

A pilot test was conducted with 15 nurses from different units and shifts who were not included in the final sample. The pilot confirmed that the questionnaire was clear, relevant, and feasible to complete within an average of 10–12 minutes. Minor wording adjustments were made based on participant feedback.

The questionnaire was organized into three major domains to address the overall study objectives. The first domain collected socio-demographic data, professional background, and work experience, providing baseline information about participants' clinical context and practice exposure. The second domain measured nurses' self-efficacy in tracheostomy care using a 5-point Likert scale, and included six items specifically assessing confidence in managing tracheostomy

patients. The third domain evaluated nurses' perceptions, readiness, and knowledge regarding tracheostomy care and related complications, and comprised 22 questions in total. Multiple-choice items 1–7 and 12–19 assessed nurses' perceptions and beliefs about tracheostomy management, while items 8–11 and 20–22 assessed readiness to manage tracheostomy-related complications and emergencies. This domain also examined core knowledge of tracheostomy care, complication recognition, and emergency management.

Confidence scores were calculated by summing responses to six Likert-scale items (range 0–30), with higher scores indicating greater confidence. Knowledge scores were calculated as the total number of correct responses across knowledge items (range 0–16), with higher scores reflecting greater knowledge.

Participant data were analyzed across multiple dimensions to obtain a comprehensive assessment of nurses' competence in tracheostomy care. The analysis evaluated participants' knowledge of tracheostomy management, their readiness to manage tracheostomy-related complications, and their confidence in providing routine and emergency care. Relationships between confidence, perceptions, and practice readiness were explored, and the influence of socio-demographic and professional factors on these outcomes was examined. This approach provided an integrated understanding of nurses' knowledge, attitudes, and preparedness for the care of patients with tracheostomy. Internal consistency reliability (eg, Cronbach's alpha) was not formally calculated because the instrument primarily comprised knowledge-based multiple-choice items; this is acknowledged as a methodological limitation.

## Potential Bias

This study relied on self-reported data, which were not independently verified against institutional records due to the anonymous nature of the survey and may therefore be subject to reporting bias. In addition, variations in nurses' interpretation of questionnaire items may have influenced response accuracy, and voluntary participation introduces a potential risk of selection bias.

## Sample Size

The sample size was calculated based on findings from a previous study, where the average knowledge regarding tracheostomy care in nurses was reported as  $21.6 \pm 9.11$ .<sup>12</sup> Using a 95% confidence interval and a standard deviation of 9.11, the minimum required sample size was 937 nurses. To account for a 10% non-response rate, the final target sample size increased to approximately ~1030 nurses, and the final achieved sample size ( $n=1109$ ) exceeded the estimated required sample size ( $n \approx 1030$ ), indicating adequate study power and supporting adequate participation.

## Statistical Analysis

Descriptive statistics including means, standard deviations, frequencies, and percentages, used to summarize demographic characteristics and other key study variables, independent t tests and one-way ANOVA were used to compare confidence and knowledge scores across categorical variables such as gender, educational background, work experience, and healthcare setting. Standard multivariable linear regression was conducted to identify significant predictors of confidence and knowledge, adjusting for potential confounders. Statistical significance was set at  $p < 0.05$ , and all analyses were performed using STATA 17.0, and hierarchical or stepwise procedures were not used.

## Results

The study included 1109 nurses responded to the survey invitation, mostly were females (79.1%) with a mean age of  $36.6 \pm 7.4$  years. Geographically, most nurses were from South Asia (45.9%), followed by Southeast Asia (35.1%), the Middle East & Africa (11.6%), and Western countries (7.4%). The majority were as staff nurses (93.4%) and had an average of  $4.4 \pm 5.1$  years of experience within the participating healthcare system, and  $12.0 \pm 7.0$  years of total professional experience. Educationally, 70.6% had a bachelor's degree, 25.4% had a diploma and 4% had master's degree. Work areas included non-critical medical, surgical, or trauma units (44.6%), critical care units (30.3%), home care (21.8%), emergency departments (2.6%), and outpatient care (0.6%). Most of the nurses treated adult patients (83.3%), with smaller groups handling pediatric cases (9.1%) or both adult and pediatric populations (7.6%). Regarding direct involvement in tracheostomy care, 36.6% of nurses reported providing care on a daily basis, while others reported

providing care weekly (12.2%), monthly (12.0%), or yearly (11.7%). In addition, (27.5%) reported no prior direct involvement in tracheostomy care. Moreover, (67.8%) of nurses had a signed competency for tracheostomy care, but (32.2%) did not. About half (53.6%) had received tracheostomy-related training, including emergency training and (48.1%) had encountered a tracheostomy airway emergency (Table 1).

**Table 1** Participant Characteristics and Experiences of Nurses Providing Tracheostomy Care

Variables	Level	Value
N		1109
Gender	Male	229 (20.9%)
	Female	867 (79.1%)
Age (years), mean (SD)		36.6 (7.4)
Region	Middle East & Africa	124 (11.6%)
	South Asia	491 (45.9%)
	Southeast Asia	375 (35.1%)
	Western	79 (7.4%)
Role	Charge Nurse	58 (5.3%)
	Head Nurse	6 (0.5%)
	Nurse Educator	8 (0.7%)
	Staff Nurse	1019 (93.4%)
Years of experience in HMC (Years), mean (SD)		4.4 (5.1)
Total years of experience (Years), mean (SD)		12.0 (7.0)
Educational level	Diploma	279 (25.4%)
	Bachelor's degree	776 (70.6%)
	Master's degree	44 (4.0%)
Current work area in HMC	Critical Care Unit	288 (30.3%)
	Emergency Department	25 (2.6%)
	Home Care	207 (21.8%)
	Non-Critical Units Medical/Surgical/Trauma	424 (44.6%)
	Outpatient	6 (0.6%)
Patient group	Adult	909 (83.3%)
	General (Adults and Pediatrics)	83 (7.6%)
	Pediatric	99 (9.1%)
How often you are caring of tracheostomy patients:	Daily	398 (36.6%)
	Weekly	132 (12.2%)
	Monthly	130 (12.0%)
	Yearly	127 (11.7%)
	Never	299 (27.5%)

(Continued)

**Table 1** (Continued).

Variables	Level	Value
Do you have a signed competency for tracheostomy care?	No	350 (32.2%)
	Yes	738 (67.8%)
Did you get any tracheostomy-related training, including tracheostomy emergency	No	508 (46.4%)
	Yes	587 (53.6%)
Have you treated a patient with a tracheostomy airway emergency?	No	570 (51.9%)
	Yes	528 (48.1%)

Table 2 presents the confidence and knowledge scores of the participants. The average confidence score was  $21.0 \pm 6.2$ , ranging from a minimum of 1 to a maximum of 30, regarding the knowledge the mean score was  $8.3 \pm 2.6$ , with scores ranging from 0 to 16 which is suggesting a moderate level of knowledge.

Table 3 showed the association with confidence and knowledge scores with demographic variables. Males reported a higher average confidence score ( $21.9 \pm 6.0$ ) compared to females ( $20.8 \pm 6.3$ ;  $p = 0.016$ ). In terms of roles, nurse educators had the highest confidence ( $25.3 \pm 5.4$ ), followed by head nurses ( $24.0 \pm 0.0$ ) and charge nurses ( $22.5 \pm 6.0$ ), with staff nurses showing the lowest ( $20.9 \pm 6.3$ ;  $p = 0.033$ ). Confidence was also linked to educational level, with

**Table 2** Confidence and Knowledge Scores of Participants

	Mean $\pm$ SD	Range
Confidence score	$21.0 \pm 6.2$	1 to 30
Knowledge	$8.3 \pm 2.6$	0 to 16

**Table 3** Association Between Confidence and Knowledge Scores with Socio-Demographic and Work Variables

Variables	N	Confidence, Mean (SD)	p value	Knowledge, Mean (SD)	p value
<b>Gender</b>					
Male	229	21.9 (6.0)	0.016	8.7 (2.6)	0.027
Female	867	20.8 (6.3)		8.3 (2.5)	
<b>Role</b>					
Charge Nurse	58	22.5 (6.0)	0.033	9.5 (3.0)	0.002
Head Nurse	6	24.0 (0.0)		8.8 (2.9)	
Nurse Educator	8	25.3 (5.4)		9.9 (1.2)	
Staff Nurse	1019	20.9 (6.3)		8.3 (2.5)	
<b>Education Level</b>					
Diploma	279	20.3 (6.5)	0.040	7.7 (2.2)	<0.001
Bachelor's degree	776	21.1 (6.2)		8.6 (2.6)	
Master's degree	44	22.7 (5.4)		9.2 (2.4)	

(Continued)

Table 3 (Continued).

Variables	N	Confidence, Mean (SD)	p value	Knowledge, Mean (SD)	p value
<b>Patient group</b>					
Adult	909	21.2 (6.2)	0.001	8.5 (2.5)	<0.001
General (Adults and Pediatrics)	83	21.4 (6.6)		8.8 (2.9)	
Pediatric	99	18.8 (6.3)		7.4 (2.2)	
<b>How often you are caring of tracheostomy patients</b>					
Daily	398	22.7 (6.3)	<0.001	8.9 (2.4)	<0.001
Weekly	132	21.3 (6.0)		9.0 (2.7)	
Monthly	130	21.2 (5.9)		8.5 (3.0)	
Yearly	127	20.4 (5.7)		8.2 (2.3)	
Never	299	18.8 (6.0)		7.4 (2.4)	
Have you treated a patient with a tracheostomy airway emergency?					
No	570	19.0 (6.1)	<0.001	7.9 (2.5)	<0.001
Yes	528	23.1 (5.7)		8.8 (2.5)	
<b>Tracheostomy-related training, including tracheostomy emergency</b>					
No	508	19.3 (6.3)	<0.001	7.6 (2.5)	<0.001
Yes	587	22.5 (5.9)		9.0 (2.4)	
<b>Do you have a signed competency for tracheostomy care?</b>					
No	350	18.2 (6.3)	<0.001	7.2 (2.4)	<0.001
Yes	738	22.3 (5.8)		9.0 (2.4)	
<b>Region</b>					
Middle East & Africa	124	21.0 (7.0)	0.11	8.0 (2.7)	0.022
South Asia	491	20.9 (6.4)		8.3 (2.5)	
Southeast Asia	375	20.9 (5.6)		8.7 (2.5)	
Western	79	22.7 (6.5)		8.6 (2.7)	
<b>Working Unit</b>					
Critical Care Unit	288	23.2 (5.6)	<0.001	9.6 (2.6)	<0.001
Emergency Department	25	18.4 (5.4)		6.6 (2.3)	
Home Care	207	21.3 (5.5)		7.9 (2.3)	
Non-Critical Medical/Surgical/Trauma Units	424	19.4 (6.6)		8.1 (2.4)	
Outpatient	6	19.3 (6.2)		5.8 (3.2)	

master's degree holders scoring highest ( $22.7 \pm 5.4$ ), followed by bachelor's ( $21.1 \pm 6.2$ ) and diploma holders ( $20.3 \pm 6.5$ ;  $p = 0.040$ ). Confidence level varied by patient group, being highest among those treating general populations ( $21.4 \pm 6.6$ ), followed by adults ( $21.2 \pm 6.2$ ) and lowest among pediatric nurses ( $18.8 \pm 6.3$ ;  $p = 0.001$ ). Confidence level was

highest in those who provide care daily ( $22.7 \pm 6.3$ ) and lowest in those never providing care ( $18.8 \pm 6.0$ ;  $p < 0.001$ ). Similarly, nurses who had treated a tracheostomy emergency ( $23.1 \pm 5.7$ ) or received related training ( $22.5 \pm 5.9$ ) showed significantly higher confidence than their counterparts ( $p < 0.001$  for both). Those with signed tracheostomy care competencies ( $22.3 \pm 5.8$ ) also reported higher confidence than those did not ( $18.2 \pm 6.3$ ;  $p < 0.001$ ). Confidence scores were highest in the critical care unit ( $23.2 \pm 5.6$ ), while the emergency department ( $18.4 \pm 5.4$ ) and outpatient units ( $19.3 \pm 6.2$ ) reported the lowest ( $p < 0.001$ ).

In terms of knowledge males had higher knowledge scores ( $8.7 \pm 2.6$ ) compared to females ( $8.3 \pm 2.5$ ;  $p = 0.027$ ). Among roles, nurse educators exhibited the highest knowledge ( $9.9 \pm 1.2$ ), followed by charge nurses ( $9.5 \pm 3.0$ ) and head nurses ( $8.8 \pm 2.9$ ), with staff nurses scoring the lowest ( $8.3 \pm 2.5$ ;  $p = 0.002$ ). Knowledge was highest among nurses with a master's degree ( $9.2 \pm 2.4$ ), followed by bachelor's ( $8.6 \pm 2.6$ ) and diploma holders ( $7.7 \pm 2.2$ ;  $p < 0.001$ ). Nurses caring for general patient groups had higher knowledge ( $8.8 \pm 2.9$ ) than those caring for adults ( $8.5 \pm 2.5$ ) or pediatric patients ( $7.4 \pm 2.2$ ;  $p < 0.001$ ).

Nurses those providing tracheostomy care daily ( $8.9 \pm 2.4$ ) or weekly ( $9.0 \pm 2.7$ ) had higher knowledge as compared to those who never provided such care ( $7.4 \pm 2.4$ ;  $p < 0.001$ ). Nurses who had treated tracheostomy emergencies ( $8.8 \pm 2.5$ ) or received related training ( $9.0 \pm 2.4$ ) scored significantly higher than those who had not ( $p < 0.001$  for both). Those with signed tracheostomy care competencies ( $9.0 \pm 2.4$ ) scored higher than those without ( $7.2 \pm 2.4$ ;  $p < 0.001$ ). Knowledge was highest among nurses in critical care units ( $9.6 \pm 2.6$ ) and lowest in the outpatient ( $5.8 \pm 3.2$ ) and emergency departments ( $6.6 \pm 2.3$ ;  $p < 0.001$ ) (Table 3).

Table 4 shows the significant predictors of knowledge and confidence scores, total years of experience were positively associated with higher knowledge scores ( $\beta = 0.05$ , 95% CI: 0.01–0.09,  $p = 0.017$ ), indicating that greater professional experience enhances knowledge. Regional differences were also evident, with nurses from Southeast Asia scoring significantly higher than those from the Middle East & Africa ( $\beta = 0.95$ , 95% CI: 0.4–1.5,  $p = 0.001$ ),

**Table 4** Factors Influencing Confidence and Knowledge Among Nurses in Tracheostomy Care

	Knowledge		Confidence	
	$\beta$ (95% CI)	<i>p</i> value	$\beta$ (95% CI)	<i>p</i> value
Age in years	-0.01 (-0.04,0.03)	0.66	-	-
Gender				
Male	Ref		Ref	
Female	-0.17 (-0.57,0.23)	0.399	-0.77 (-1.69,0.15)	0.1
Years of experience in HMC in Years	0 (-0.04,0.05)	0.865	-0.005 (-0.1,0.1)	0.929
Total years of experience in Years	0.05 (0.01,0.09)	0.017	-0.005 (-0.07,0.06)	0.893
Region				
Middle East & Africa	Ref		-	-
South Asia	0.35 (-0.17,0.88)	0.188	-	-
Southeast Asia	0.95 (0.4,1.5)	0.001	-	-
Western	-0.61 (-1.46,0.24)	0.158	-	-
Role				
Charge Nurse	Ref		Ref	
Head Nurse	-0.61 (-2.58,1.36)	0.541	1.09 (-3.65,5.83)	0.652

(Continued)

**Table 4** (Continued).

	Knowledge		Confidence	
	$\beta$ (95% CI)	p value	$\beta$ (95% CI)	p value
Nurse Educator	0.65 (-1.3,2.61)	0.512	2.82 (-1.91,7.54)	0.242
Staff Nurse	-0.54 (-1.29,0.2)	0.154	-0.75 (-2.47,0.97)	0.391
Patient group				
Adult	Ref		Ref	
General (Adults and Pediatrics)	0.08 (-0.53,0.69)	0.795	-0.38 (-1.81,1.05)	0.603
Pediatric	-0.76 (-1.38, -0.15)	0.015	-1.13 (-2.57,0.31)	0.122
Current work unit				
Critical Care Unit	Ref		Ref	
Emergency Department	-2.56 (-3.59,-1.52)	<0.001	-3.21 (-5.76, -0.65)	0.014
Home Care	-0.95 (-1.47, -0.44)	<0.001	0.88 (-0.29,2.05)	0.141
Non-Critical Medical/Surgical/T.	-1.31 (-1.71, -0.9)	<0.001	-2.36 (-3.28, -1.44)	<0.0001
Outpatient	-2.96 (-4.87, -1.05)	0.002	-1.14 (-5.7,3.41)	0.622
Having signed competency for tracheostomy care				
No	Ref		Ref	
Yes	0.9 (0.49,1.31)	<0.001	2.45 (1.48,3.42)	<0.0001
Tracheostomy related training, including tracheostomy emergency				
No	Ref		Ref	
Yes	0.93 (0.55,1.3)	<0.001	1.52 (0.63,2.4)	0.001
Treated patient with tracheostomy airway emergency				
No	Ref		Ref	
Yes	0.12 (-0.22,0.47)	0.481	2.78 (1.96,3.59)	<0.0001

and pediatric nurses scored lower compared to those caring for adult patients ( $\beta = -0.76$ , 95% CI:  $-1.38$  to  $-0.15$ ,  $p = 0.015$ ). Compared to nurses in critical care, those working in the emergency department ( $\beta = -2.56$ , 95% CI:  $-3.59$ ,  $-1.52$   $p < 0.001$ ), non-critical medical/surgical units ( $\beta = -1.31$ , 95% CI:  $-1.71$ ,  $-0.9$   $p < 0.001$ ), home care ( $\beta = -0.95$ , 95% CI:  $-1.47$ ,  $-0.44$   $p < 0.001$ ), and outpatient settings ( $\beta = -2.96$ , 95% CI:  $-4.87$ ,  $-1.05$   $p = 0.002$ ) scored lower. Moreover nurses who held signed tracheostomy care competencies ( $\beta = 0.9$ , 95% CI:  $0.49$ ,  $1.31$   $p < 0.001$ ) or had undergone tracheostomy-related training ( $\beta = 0.93$ , 95% CI:  $0.55$ ,  $1.3$   $p < 0.001$ ) exhibited significantly higher knowledge scores.

Nurses working in the emergency department ( $\beta = -3.21$ , 95% CI:  $-5.76$  to  $-0.65$ ,  $p = 0.014$ ) and non-critical units ( $\beta = -2.36$ , 95% CI:  $-3.28$  to  $-1.44$ ,  $p < 0.0001$ ) reported lower confidence compared to critical care areas, confidence level was higher among nurses with a signed tracheostomy care competency ( $\beta = 2.45$ , 95% CI:  $1.48$  to  $3.42$ ,  $p < 0.0001$ ) and those who had received related training ( $\beta = 1.52$ , 95% CI:  $0.63$  to  $2.4$ ,  $p = 0.001$ ). Furthermore nurses who had experienced tracheostomy airway emergencies showed significantly greater confidence ( $\beta = 2.78$ , 95% CI:  $1.96$  to  $3.59$ ,  $p < 0.0001$ ) (Table 4).

## Discussion

The study provides valuable insight into the demographic backgrounds and professional experiences of nurses and examines their knowledge, perceptions, confidence in providing tracheostomy care, and readiness to manage tracheostomy emergencies. The findings help identify potential areas for improvement and the challenges nurses encounter during tracheostomy-related emergency situations. The study highlights the need for targeted training programs and policy interventions as essential foundations for strategic initiatives aimed at improving nursing practice and patient outcomes.

A total of 1109 nurses responded to the survey, and the demographic profile aligns with global nursing workforce trends, with a predominance of female nurses and substantial representation from South Asia and Southeast Asia. These regional patterns reflect the dependence on overseas nursing staff in many healthcare systems, and the distribution of educational levels and work settings underscores the diversity of the nursing workforce, with most nurses holding a bachelor's degree and working in non-critical or critical care units.<sup>24</sup>

This study is distinctive because it examines nursing confidence in tracheostomy care, an area that has received less attention in previous research, which has focused mainly on knowledge and clinical competencies.<sup>12,16</sup> The results showed an overall average confidence score of 21.0 out of 30, with significant variation based on demographic and professional factors. Nurses working in critical care units, male nurses, and those with advanced degrees achieved the highest confidence scores, whereas nurses in emergency and outpatient settings reported considerably lower confidence. Nurses who cared for tracheostomy patients daily or had managed tracheostomy emergencies demonstrated greater confidence, and those who completed formal tracheostomy training and competency certification also showed higher confidence levels.

The study demonstrated a moderate level of knowledge regarding tracheostomy care, with an average score of 8.3 out of 16, consistent with previous reports of knowledge gaps in this field as highlighted by Alotaibi et al.<sup>12</sup> Male nurses achieved slightly higher knowledge scores than female nurses (8.7 vs 8.3), which contrasts with findings from Abu-Sahyoun et al<sup>16</sup> who reported higher knowledge among female nurses.

Among nursing roles, nurse educators achieved the highest knowledge scores (9.9), followed by charge nurses (9.5), head nurses (8.8), and staff nurses (8.3). Although the number of nurse educators and head nurses was small, this suggests that leadership roles and advanced expertise contribute to greater knowledge, consistent with evidence that collaborative multidisciplinary tracheostomy initiatives improve care processes and outcomes.<sup>10,21,22,25</sup> Educational level also influenced knowledge, with master's degree holders scoring 9.2, bachelor's 8.6, and diploma holders 7.7, consistent with Mwakanyanga et al<sup>26</sup> who found higher education associated with better knowledge and practice.

In addition, regional variation in knowledge scores was observed; however, these differences should be interpreted with caution due to unequal subgroup representation. Most participants were from South Asia (45.9%) and Southeast Asia (35.1%), while smaller proportions were from the Middle East & Africa (11.6%) and Western countries (7.4%). Nevertheless, these descriptive findings suggest that contextual and cultural factors—such as peer support, shared learning practices, and teamwork norms—may be relevant considerations for future training and educational initiatives; however, such factors cannot be determined from the present cross-sectional design.

Workplace environment was a key determinant; critical care nurses demonstrated significantly higher knowledge than those in emergency and outpatient departments ( $p < 0.001$ ), and frequent exposure to tracheostomy patients was associated with better knowledge ( $p < 0.001$ ). These disparities support findings by Sodhi et al that dedicated nurse training programs was linked to improve outcomes and reduce complications.<sup>27</sup>

Structured training and competency programs had a major impact. Nurses who completed a tracheostomy competency checklist scored higher (9.0) than those without competency ( $p < 0.001$ ), and those who attended tracheostomy-related training also scored higher ( $p < 0.001$ ). These findings align with Yelverton et al<sup>14</sup> and Wilkinson et al<sup>7</sup>, who emphasized that standardized education and structured systems enhance safety and competence. However, given the cross-sectional design, these findings reflect associations and should not be interpreted as causal relationships. The study also identified the need for additional support and supervised practice, particularly in emergency and outpatient departments.

These variations emphasize the importance of targeted educational initiatives. Simulation-based tracheostomy education improves provider confidence, knowledge, and emergency management skills.<sup>28</sup> Structured nurse training

further enhances self-efficacy and preparedness.<sup>29,30</sup> High-acuity unit rotations may also strengthen experiential learning and clinical readiness.

Addressing these gaps through specialized comprehensive targeted training programs based on nurses' qualifications, position, and area of experience can help ensure consistent knowledge levels and can be associated with improved tracheostomy care outcomes across different healthcare settings.

While this study aligns with existing global evidence, it uniquely examined the influence of exposure to tracheostomy-related emergency situations on nurses' confidence and identified specific competency gaps across multiple hospital units. Nurses working in non-critical care settings—particularly pediatric and outpatient units—demonstrated lower levels of confidence and knowledge, underscoring the need for unit-specific, competency-based educational interventions. These findings suggest that patient outcomes may be optimized when differences in clinical context and care environments are systematically addressed.

A key concern identified was the ability to manage tracheostomy emergencies, which was strongly linked to both confidence and knowledge levels. Nurses with prior experience handling tracheostomy emergencies exhibited significantly higher confidence and knowledge compared with those without such experience. Similarly, nurses who underwent formal tracheostomy training had greater confidence and knowledge, with statistically significant differences ( $p < 0.001$  for both), and completion of a competency assessment checklist further increased preparedness, as reflected in higher confidence and knowledge ( $p < 0.001$  for both). These findings are consistent with previous studies demonstrating that structured training programs and certification enhance readiness for high-risk situations.<sup>14,29</sup>

Critical care nurses achieved the highest levels of readiness due to their extensive experience with tracheostomy care and emergency situations, whereas staff in outpatient and emergency departments displayed the lowest readiness scores because of limited practical exposure and fewer specialized training opportunities, as corroborated by Sodhi et al<sup>27</sup> highlighted how targeted interventions for specific units help close emergency management skill gaps.<sup>27</sup>

Healthcare systems need to prioritize targeted training programs, including simulation-based education and structured clinical care pathways to enhance nurses' readiness for managing tracheostomized patients and tracheostomy emergencies, while evidence indicates that integrating nursing education within standardized care pathways and multidisciplinary teamwork improves nurses' confidence, knowledge, and emergency preparedness, ultimately leading to safer and more consistent tracheostomy care delivery, through these strategies, institutions can strengthen essential nursing competencies, reduce tracheostomy-related complications, and improve overall patient outcomes.<sup>15,16,21,22,31,32</sup>

## Limitations

The study has several limitations that should be considered. First, the cross-sectional design captured data at a single point in time, which limits the ability to establish causal relationships. Although meaningful associations were observed, future longitudinal or experimental studies are needed to confirm these findings and to evaluate long-term outcomes.

Second, the use of self-reported data may have introduced response bias, as participants could have overestimated or underestimated their actual knowledge and confidence levels. Additionally, because participation was voluntary, there is a potential for selection bias, with more motivated or experienced nurses being more likely to respond.

Finally, regarding generalizability, the study was conducted within a single healthcare system in one country, which may limit the applicability of the results to other settings with different protocols, resources, or workforce structures. However, the findings may still be relevant to similar healthcare systems in the Gulf region, where nursing staff often share comparable backgrounds and challenges. Future research involving multiple centers and mixed-methods approaches would help to validate and broaden these insights.

## Conclusion

The study showed that structured training programs combined with hands-on experience are associated with higher nurse proficiency and confidence in managing tracheostomy care. Nurses working in critical care units demonstrated greater readiness compared with their peers in other departments. Those with previous experience in tracheostomy emergencies and those who had received formal training displayed better preparedness, highlighting the value of targeted, evidence-based educational interventions. Given that this study was conducted within a single healthcare system, the findings

should be interpreted with appropriate caution; however, they suggest that healthcare systems may benefit from prioritizing specialized education, simulation-based training, and rotations in high-acuity units. Emphasizing interdisciplinary collaboration among nurses, physicians, and respiratory therapists may further strengthen tracheostomy care and emergency management. Future research, including multicenter and longitudinal studies incorporating objective competency measures, is needed to evaluate long-term impacts and inform sustainable practice improvements across diverse clinical and cultural settings.

## Recommendations

Healthcare institutions should establish structured training programs, including theoretical teaching and simulation-based learning, to address proficiency gaps in tracheostomy care. Healthcare systems ought to require regular competency checks using standardized assessments and certification programs to maintain airway management skills and ensure adherence to best practices. Continuous cross-training between different nursing units should be implemented, particularly between nurses in low-tracheostomy-exposure areas and those in high-acuity critical care environments, to strengthen confidence, hands-on experience, and practical knowledge. Additionally, healthcare settings should establish multidisciplinary tracheostomy care teams that include nurses, physicians, and respiratory therapists to enhance care coordination and ensure consistent, high-quality management across different clinical environments.<sup>21,22,29–32</sup>

The implementation of these measures can enhance nurses' confidence and knowledge while improving emergency preparedness, ultimately can be linked to better patient safety and improved tracheostomy care outcomes.

## Data Sharing Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

## Ethical Considerations and Participant Consent

Ethical approval for this study was obtained from the Medical Research Center, Hamad Medical Corporation, Doha, Qatar (*No. MRC-01-23-843*). The study was conducted in accordance with institutional regulations and the principles of the Declaration of Helsinki. Participation was voluntary, and informed consent was obtained electronically prior to survey completion. Participants reviewed an online information sheet describing the study purpose, anonymity, and confidentiality, and consented by selecting the “Agree and proceed” option before accessing the questionnaire. No identifiable personal data were collected to ensure confidentiality. Artificial-intelligence-based tools (eg, Grammarly) were used solely for language clarity enhancement; all study design, data interpretation, and analyses were independently developed by the authors.

## Patient or Public Contribution

No Patient or Public Contribution as this study did not involve patients, service users, caregivers, or members of the public in its design, conduct, analysis, or manuscript preparation, as it focused exclusively on healthcare professionals' (Nurses) self-reported practices and perceptions related to tracheostomy care.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors declare that they have no competing interests in this work.

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