

ASSESSMENT OF KNOWLEDGE AND SKILLS REGARDING TRACHEOSTOMY CARE AMONG UNDERGRADUATE NURSING STUDENTS OF PRIVATE SECTOR UNIVERSITY

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Abstract

Background: Tracheostomy care requires adequate theoretical knowledge and practical skills among nursing students to ensure safe airway management and prevent complications. Inadequate preparation may compromise patient safety and nursing care quality. Assessing students' knowledge and skills can identify educational gaps and guide improvements in undergraduate nursing education.

Aim: The study aimed to assess the knowledge and practical skills regarding tracheostomy care among undergraduate nursing students and determine the association between selected demographic characteristics, knowledge, and skills.

Methods: A quantitative cross-sectional study was conducted among 150 undergraduate nursing students. Data were collected using a structured questionnaire assessing knowledge and a skills assessment checklist related to tracheostomy care. Descriptive statistics were used to summarize the data. Chi-square tests were applied to determine associations between selected variables, knowledge, and skills. Statistical significance was considered at $p < 0.05$.

Results: Half of the participants, 75 (50.0%), demonstrated moderate knowledge, while 43 (28.7%) had good and 32 (21.3%) had poor knowledge. The mean knowledge score was 10.84 ± 2.61 . Regarding skills, 67 (44.7%) demonstrated moderate skills, 47 (31.3%) good skills, and 36 (24.0%) poor skills. Academic year was significantly associated with knowledge ($p = 0.021$) and skills ($p < 0.001$). Clinical exposure was significantly associated with knowledge ($p = 0.002$). Knowledge was significantly associated with skills ($p < 0.001$).

Conclusion: The findings indicated moderate knowledge and skills regarding tracheostomy care among nursing students. Structured theoretical teaching, clinical exposure, simulation-based training, and supervised practical practice are recommended to strengthen competency.

Introduction

For safe and efficient treatment, tracheostomy is an essential clinical technique that requires both theoretical understanding and practical proficiency. To guarantee patient safety and

provide high-quality care, undergraduate nursing students need to learn these crucial skills. Many nursing students, however, lack enough knowledge and practical experience in managing tracheostomies, according to many studies (Smith

et al., 2021). These knowledge and ability deficits are mostly caused by a lack of organized training and limited exposure to clinical practice (Thompson et al., 2022).

A number of crucial practices, including suctioning, infection control, and emergency response, are part of proper tracheostomy care. Only a tiny portion of nursing students exhibit mastery in these competencies, according to studies. Just 40% of undergraduate nursing students, for example, had sufficient knowledge of tracheostomy care, especially with regard to suctioning and infection control, according to a research evaluating their knowledge and abilities (Smith et al., 2021). The significance of practical exposure was shown by the fact that students who had previously received hands-on training outperformed those who had only received theoretical instruction.

Enhancing tracheostomy care training has been found to be possible via the use of simulation-based learning. A research by Johnson et al. (2020) contrasted simulation-based training with conventional theoretical education. According to the results, students who participated in simulation-based learning exhibited improved information retention and increased confidence when performing tracheostomy-related procedures. This implies that interactive, practical instruction is essential for fostering nursing students' ability.

Effective learning is hampered by a number of obstacles, despite the significance of tracheostomy care training. Insufficient exposure to pediatric tracheostomy patients, a lack of standard protocols, and a lack of practical training opportunities were among the difficulties mentioned in a research by Roberts et al. (2019). Many students said that their lack of practical experience left them feeling unprepared for real-life scenarios. According to the study, early clinical experience and organized mentorship programs might close this gap and raise students' preparedness.

Technology has also been investigated as a way to improve tracheostomy care abilities in nursing education. The usefulness of e-learning resources in enhancing nursing students' proficiency in caring for pediatric tracheostomy patients was investigated by Patel et al. (2023). After using digital resources,

students' knowledge scores improved by 45%, according to the research, which incorporated an online learning module into nursing courses. Important ideas like suctioning, infection control, and emergency management were easier to comprehend and remember because to the participatory element of e-learning. This implies that digital learning can be a useful addition to conventional teaching techniques.

Another important aspect affecting nursing students' proficiency in tracheostomy care is clinical exposure. A study by Thompson et al. (2022) examined how clinical rotations affected students' self-esteem and tracheostomy maintenance abilities. The findings showed that students with more practical clinical experience were more capable and self-assured in their ability to care for tracheostomy patients than those with less experience. Additionally, supervisors noted that students who had direct patient contact were more equipped to manage crises, highlighting the necessity of more chances for hands-on training in nursing school.

Additionally, it has been demonstrated that incorporating evidence-based recommendations into nursing courses improves students' clinical decision-making and procedural accuracy. According to Thompson et al. (2022), students who were trained according to standardized norms outperformed those who were taught conventionally in tracheostomy care. Patient safety is increased and training consistency is guaranteed when evidence-based methods are included into nursing education.

Maintaining nursing students' proficiency in tracheostomy care also heavily relies on continuing education and recurring refresher courses. A longitudinal research evaluating the effect of continuing education on students' confidence and skill retention was carried out by Brown et al. in 2024. The results showed that compared to students who simply got initial training, those who participated in organized continuing education programs showed higher performance and longer skill retention. According to the report, frequent refresher courses and practical workshops should be included to guarantee nursing students' continued proficiency.

In conclusion, undergraduate nursing students must get proper training in tracheostomy care; nevertheless, obstacles include a lack of established standards, insufficient training resources, and limited clinical exposure impede their learning. In order to increase students' proficiency in tracheostomy management, studies have emphasized the value of simulation-based training, clinical exposure, technology-assisted learning, and evidence-based guidance. Nursing students' readiness and patient care may be improved by addressing these obstacles through curricular enhancements, organized mentoring, and ongoing education.

Methods

A descriptive cross-sectional study design was used to assess knowledge and skills regarding tracheostomy care among undergraduate nursing students at Superior College of Nursing, Superior University, Lahore. The target population comprised male and female students enrolled in the 2nd, 3rd, and 4th years of the undergraduate nursing program. The study was conducted over approximately nine months. A sample of 150 students was selected from a population of 240 using Slovin's formula with a 5% margin of error. A random sampling technique was used to select eligible participants. Students from the 2nd, 3rd, and 4th years who were enrolled at the institution, available during data collection, willing to participate, and provided informed consent were included. First-year students, students from other institutions, non-undergraduate healthcare professionals, and those unwilling to participate were excluded. Data were collected using a structured questionnaire adapted to assess knowledge and skills related to tracheostomy care.

Results

Demographic Analysis

Table 1: Demographic Characteristics of Participants (n = 150)

Variable	Category	Frequency (f)	Percentage (%)
Age (years)	18-20	45	30.0
	21-23	67	44.7
	24-26	30	20.0
	>26	8	5.3
Gender	Male	58	38.7

Ethical approval and administrative permission were obtained before the study. Participation was voluntary, informed consent was obtained, and confidentiality and privacy were maintained.

Data Collection Procedure

The researcher personally visited Superior College of Nursing, Superior University, Lahore, to collect the data. Randomly selected eligible participants were approached and informed about the purpose, objectives, and procedure of the study. Written informed consent was obtained before distributing the questionnaire. Participants completed the structured questionnaire independently and were provided sufficient time to respond to all items. The researcher remained available to clarify questions related to the questionnaire without influencing participants' responses. After completion, questionnaires were collected and checked for completeness and accuracy. Each questionnaire was coded systematically to maintain confidentiality and facilitate data entry and statistical analysis.

Data Analysis Procedure

The collected data were coded, entered, and analyzed using Statistical Package for the Social Sciences (SPSS) version 27. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were calculated to summarize demographic characteristics and knowledge and skills scores. Inferential statistics were used to determine associations between selected demographic variables, knowledge, and skills regarding tracheostomy care. The Chi-square test was applied to assess associations between categorical variables. Statistical significance was determined at a p-value of less than 0.05.

	Female	92	61.3
Academic Year	2nd Year	48	32.0
	3rd Year	51	34.0
	4th Year	51	34.0
Clinical Exposure to Tracheostomy Patients	Yes	81	54.0
	No	69	46.0
Previous Practical Experience in Tracheostomy Care	Yes	62	41.3
	No	88	58.7

Interpretation:

Table 4.1 shows the demographic characteristics of the 150 nursing students. The largest proportion of participants, 67 (44.7%), belonged to the age group of 21–23 years, followed by 45 (30.0%) participants aged 18–20 years. Regarding gender, the majority were female, 92 (61.3%), while 58 (38.7%) were male. In terms of academic year, 48 (32.0%)

participants were from the 2nd year, whereas 51 (34.0%) each were from the 3rd and 4th years. A total of 81 (54.0%) students reported clinical exposure to tracheostomy patients, whereas 69 (46.0%) had no such exposure. Previous practical experience in tracheostomy care was reported by 62 (41.3%) students, while 88 (58.7%) had no previous practical experience.

Table 2: Overall Knowledge Regarding Tracheostomy Care Among Nursing Students

Knowledge Level	Score Range	Frequency (f)	Percentage (%)
Poor	0–7	32	21.3
Moderate	8–11	75	50.0
Good	12–15	43	28.7
Total		150	100.0

Interpretation:

Table 2 indicates that half of the nursing students, 75 (50.0%), had a moderate level of knowledge regarding tracheostomy care. A total of 43 (28.7%)

students demonstrated good knowledge, whereas 32 (21.3%) had poor knowledge. Overall, the findings suggest that the majority of students had moderate knowledge regarding tracheostomy care.

Table 3: Descriptive Statistics of Knowledge Scores Regarding Tracheostomy Care

Variable	Minimum	Maximum	Mean	Standard Deviation
Knowledge score	4	15	10.84	2.61

Interpretation:

The mean knowledge score was 10.84 with a standard deviation of 2.61. The observed knowledge scores ranged from a minimum of 4 to

a maximum of 15, indicating variation in the level of knowledge regarding tracheostomy care among nursing students.

Table 4: Knowledge of Individual Tracheostomy-Care Items Among Nursing Students

S. No.	Knowledge Item	Correct n (%)	Incorrect n (%)
1	Definition and purpose of tracheostomy	116 (77.3)	34 (22.7)
2	Indications for tracheostomy	102 (68.0)	48 (32.0)
3	Types of tracheostomy tubes	94 (62.7)	56 (37.3)
4	Components of a tracheostomy tube	88 (58.7)	62 (41.3)
5	Principles of airway assessment	97 (64.7)	53 (35.3)
6	Tracheostomy suctioning	83 (55.3)	67 (44.7)

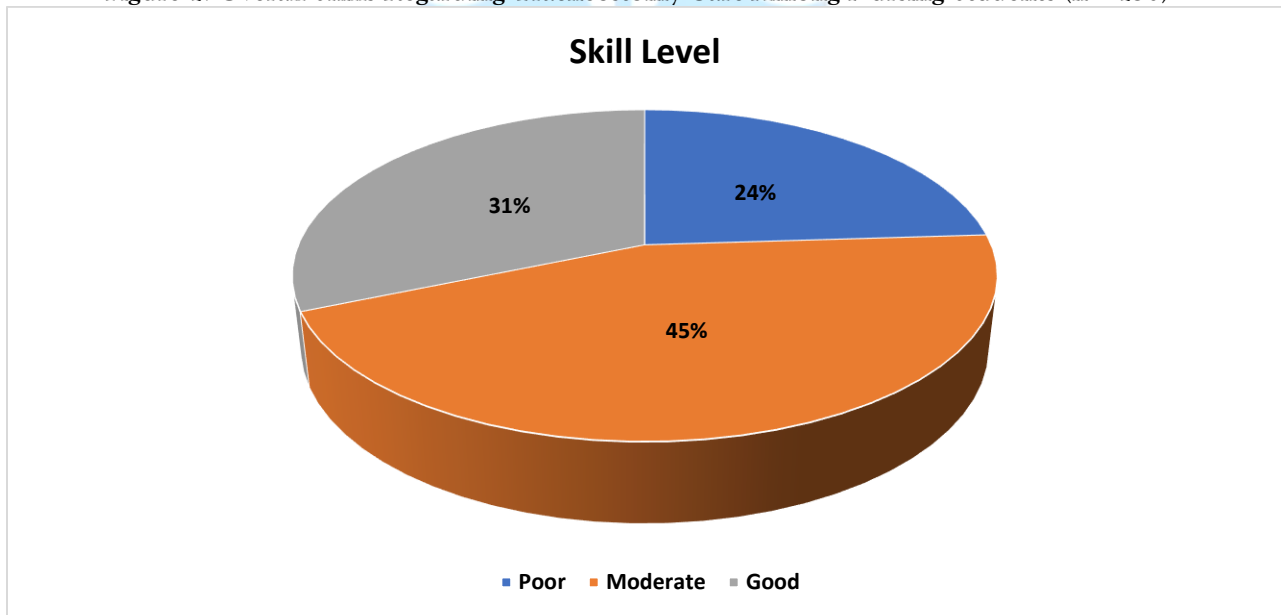
7	Cuff-pressure management	76 (50.7)	74 (49.3)
8	Tracheostomy-site care	91 (60.7)	59 (39.3)
9	Humidification and oxygen therapy	86 (57.3)	64 (42.7)
10	Prevention of tracheostomy complications	89 (59.3)	61 (40.7)
11	Recognition of airway obstruction	81 (54.0)	69 (46.0)
12	Emergency management of accidental decannulation	72 (48.0)	78 (52.0)
13	Infection-prevention measures	99 (66.0)	51 (34.0)
14	Tracheostomy tube changing	68 (45.3)	82 (54.7)
15	Patient education regarding tracheostomy care	105 (70.0)	45 (30.0)

Interpretation:

Table 4 demonstrates the students' responses to individual knowledge items. The highest proportion of correct responses was observed for the definition and purpose of tracheostomy, 116 (77.3%), followed by patient education regarding tracheostomy care, 105 (70.0%). Knowledge was

comparatively weaker regarding tracheostomy tube changing, where only 68 (45.3%) students answered correctly, and emergency management of accidental decannulation, where 72 (48.0%) responded correctly. Knowledge regarding cuff-pressure management was also limited, with 76 (50.7%) students providing correct responses.

Figure 1: Overall Skills Regarding Tracheostomy Care Among Nursing Students (n = 150)



Shows that 67 (44.7%) nursing students demonstrated a moderate level of skills in tracheostomy care. A total of 47 (31.3%) students demonstrated good skills, whereas 36 (24.0%) had

poor skills. Thus, the largest proportion of participants demonstrated a moderate level of practical skills.

Table 5: Performance on Individual Tracheostomy-Care Skills

S. No.	Skill	Competent n (%)	Not Competent n (%)
1	Hand hygiene before tracheostomy care	129 (86.0)	21 (14.0)
2	Preparation of required equipment	118 (78.7)	32 (21.3)
3	Assessment of respiratory status	111 (74.0)	39 (26.0)

4	Proper positioning of the patient	122 (81.3)	28 (18.7)
5	Tracheostomy suctioning technique	101 (67.3)	49 (32.7)
6	Maintenance of sterile/aseptic technique	95 (63.3)	55 (36.7)
7	Tracheostomy-site cleaning	108 (72.0)	42 (28.0)
8	Dressing change	103 (68.7)	47 (31.3)
9	Cuff-pressure assessment	87 (58.0)	63 (42.0)
10	Oxygen/humidification management	92 (61.3)	58 (38.7)
11	Disposal of contaminated equipment	115 (76.7)	35 (23.3)
12	Recognition of complications	84 (56.0)	66 (44.0)
13	Emergency response to tube obstruction	79 (52.7)	71 (47.3)
14	Management of accidental decannulation	70 (46.7)	80 (53.3)
15	Patient safety during tracheostomy care	121 (80.7)	29 (19.3)

Interpretation:

Table 5 indicates that the highest competency was observed in hand hygiene before tracheostomy care, with 129 (86.0%) students demonstrating competency. This was followed by proper positioning of the patient, 122 (81.3%), and patient safety during tracheostomy care, 121 (80.7%). The

lowest competency was observed in management of accidental decannulation, 70 (46.7%), followed by emergency response to tube obstruction, 79 (52.7%), and recognition of complications, 84 (56.0%). These findings indicate that students performed better in routine care activities than in emergency-related tracheostomy procedures.

Table 6 Associations Between Selected Variables, Knowledge, and Skills Regarding Tracheostomy Care Among Nursing Students (n = 150)

S. No.	Independent Variable	Outcome Variable	Statistical Test (χ^2)	p-value	Result
1	Gender	Knowledge level	1.586	0.453	Not significant
2	Academic year	Knowledge level	11.588	0.021	Significant
3	Clinical exposure	Knowledge level	12.348	0.002	Significant
4	Previous tracheostomy-care training	Knowledge level	4.833	0.089	Not significant
5	Academic year	Skills level	20.140	<0.001	Significant
6	Knowledge level	Skills level	91.407	<0.001	Significant

The consolidated findings showed that gender was not significantly associated with knowledge regarding tracheostomy care ($\chi^2 = 1.586$, $p = 0.453$), and previous tracheostomy-care training also did not demonstrate a statistically significant association with knowledge ($\chi^2 = 4.833$, $p = 0.089$). In contrast, academic year was significantly associated with knowledge ($\chi^2 = 11.588$, $p = 0.021$), with higher knowledge levels observed among students in advanced academic years. Clinical exposure to tracheostomy patients was also significantly associated with knowledge ($\chi^2 = 12.348$, $p = 0.002$). Similarly, academic year showed a statistically significant association with practical

skills ($\chi^2 = 20.140$, $p < 0.001$), indicating better skills among senior students. Finally, a highly significant association was observed between knowledge and skills regarding tracheostomy care ($\chi^2 = 91.407$, $p < 0.001$), suggesting that students with higher knowledge levels were more likely to demonstrate better practical skills.

Discussion

The present study assessed knowledge and practical skills regarding tracheostomy care among 150 nursing students. The findings showed that 50.0% of students had moderate knowledge, 28.7% had good knowledge, and 21.3% had poor knowledge.

The mean knowledge score was 10.84 ± 2.61 , indicating an overall moderate level of understanding. The finding is consistent with Abu-Sahyoun et al. (2023), who reported moderate knowledge of tracheostomy care among critical care nurses in Jordan. Their participants demonstrated moderate knowledge across several domains, including tracheostomy tubes, suctioning, and nursing responsibilities. Abu Ejheisheh et al. (2025) also reported that most ICU nurses in Palestine had moderate knowledge. The similarity suggests that tracheostomy care remains a relatively specialized area in which theoretical exposure alone may not be sufficient to develop comprehensive competency.

The present study identified considerable variation in knowledge across individual tracheostomy-care items. The highest proportion of correct responses was related to the definition and purpose of tracheostomy, 77.3%, while lower levels of correct responses were observed for tracheostomy tube changing, 45.3%, accidental decannulation management, 48.0%, and cuff-pressure management, 50.7%. Duggal et al. (2023) identified weaknesses in tracheostomy emergencies, including recognition and management of displaced tracheostomy tubes, among healthcare professionals from several disciplines. Koirala et al. (2025) reported a particularly low level of correct responses regarding tube reinsertion, with only 27.94% answering correctly. The current findings follow the same pattern, with students showing stronger knowledge of basic concepts than emergency and technically complex procedures.

The moderate knowledge level observed in this study can be understood in relation to the students' limited exposure to tracheostomy care. Only 54.0% of participants reported clinical exposure to tracheostomy patients, while 46.0% had no such exposure. Previous practical experience was reported by only 41.3% of participants. Saleem et al. (2024), in a Pakistani tertiary-care hospital, found that only 20.9% of healthcare professionals achieved at least 70% on an objective tracheostomy knowledge assessment, while experience was significantly associated with knowledge. Rodríguez-Darias and Díaz-González (2025) also emphasized the specialized nature of tracheostomy care and the

importance of appropriate knowledge and care practices for patients with tracheostomies. The present findings support the view that clinical exposure represents an important opportunity for students to connect classroom knowledge with real clinical situations.

The present study found a statistically significant association between clinical exposure and knowledge level ($\chi^2 = 12.348$, $p = 0.002$). Students who had clinical exposure demonstrated a higher proportion of good knowledge, 38.3%, compared with 17.4% among students without exposure. The finding is compatible with evidence from clinical nursing populations. Abu-Sahyoun et al. (2023) reported significant differences in tracheostomy knowledge according to work experience, while Koirala et al. (2025) found higher knowledge among nurses working in ICU environments and those with greater professional experience. Saleem et al. (2024) also reported experience as a significant factor associated with knowledge. The association in the present study provides support for incorporating structured clinical exposure to tracheostomy patients within undergraduate nursing education.

Gender was not significantly associated with knowledge level in the present study ($\chi^2 = 1.586$, $p = 0.453$). Female students had a somewhat higher proportion of good knowledge than male students, 31.5% compared with 24.1%, yet the difference did not reach statistical significance. The finding differs from Abu Ejheisheh et al. (2025), who reported significant differences in tracheostomy knowledge according to gender among ICU nurses in Palestine. Abu-Sahyoun et al. (2023) also identified a significant gender difference in the suctioning dimension of tracheostomy knowledge. The difference between the present findings and previous studies may relate to differences in participant characteristics, educational level, clinical responsibilities, sample composition, and exposure to tracheostomy patients. The participants in the current study were undergraduate nursing students, whereas the cited studies primarily assessed practicing nurses.

Academic year was significantly associated with knowledge in the current study ($\chi^2 = 11.588$, $p = 0.021$). Good knowledge was demonstrated by

41.2% of fourth-year students, compared with 31.4% of third-year students and 12.5% of second-year students. Poor knowledge was most frequent among second-year students, 31.3%. Sajji et al. (2024) specifically examined structured teaching regarding tracheostomy care among second-year GNM students and highlighted the relevance of planned educational interventions for developing knowledge. Abu-Sahyoun et al. (2023) found significant differences in tracheostomy knowledge according to educational level. The present finding suggests that progression through the nursing curriculum may provide students with greater theoretical instruction, clinical experience, and opportunities to encounter complex airway-management procedures.

The practical-skills findings showed that 44.7% of students had moderate skills, 31.3% had good skills, and 24.0% had poor skills. The mean skills score was 10.36 ± 2.89 . Competency was highest for hand hygiene, 86.0%, proper patient positioning, 81.3%, and patient safety, 80.7%. Lower competency was observed in accidental decannulation management, 46.7%, emergency response to tube obstruction, 52.7%, and recognition of complications, 56.0%. Khanum et al. (2023) reported that nurses could demonstrate adequate knowledge while practical performance remained weaker in some aspects of tracheostomy care. A Pakistani study by Khanum et al. (2023) involving ICU nurses also identified a discrepancy between knowledge and observed practice, emphasizing the need for organized clinical guidelines and practical training. The present findings indicate that routine and familiar nursing actions were performed more competently than rare, high-risk emergency procedures.

Academic year showed a statistically significant association with practical skills ($\chi^2 = 20.140$, $p < 0.001$). Good skills were demonstrated by 45.1% of fourth-year students, compared with 25.5% of third-year students and 10.4% of second-year students. Poor skills were most common among second-year students, 41.7%. Abdulrahman et al. (2021) found that an educational training program significantly improved nurses' knowledge and skills in tracheostomy care. Aslam et al. (2025) also reported a significant improvement in knowledge

and practice following a structured educational program among ICU nurses in Lahore, with particularly strong improvement in infection control, stoma care, and emergency management. The current finding supports the importance of repeated clinical practice and structured skills teaching throughout undergraduate nursing education.

Previous tracheostomy-care training was not significantly associated with knowledge in the present study ($\chi^2 = 4.833$, $p = 0.089$). Students who had received previous training had a greater proportion of good knowledge, 37.0%, compared with 24.0% among those without training, yet the difference was statistically nonsignificant. The pattern contrasts with findings from structured educational interventions. Qadir (2023) reported a significant improvement in knowledge after a structured teaching program among staff nurses, while Aslam et al. (2025) demonstrated substantial improvement in knowledge and practice after a focused educational intervention. The nonsignificant association in the current study may reflect differences in the quality, duration, recency, and practical components of previous training. A training experience may not produce sustained competency when it is brief, predominantly theoretical, or not reinforced through supervised clinical practice.

The strongest finding of the present study was the statistically significant association between knowledge and practical skills ($\chi^2 = 91.407$, $p < 0.001$). Among students with poor knowledge, 78.1% demonstrated poor skills and none demonstrated good skills. Among students with good knowledge, 67.4% demonstrated good skills. The finding is consistent with Nazir et al. (2022), who identified a significant association between nurses' knowledge and practice regarding tracheostomy care in ICU patients. Abdulrahman et al. (2021) also demonstrated that educational improvement in tracheostomy knowledge was accompanied by improvement in clinical skills. The relationship between knowledge and skills in the current study emphasizes the importance of integrating theoretical instruction with demonstration, return demonstration, simulation, supervised clinical practice, and competency

assessment. Duggal et al. (2023) recommended standardized education after identifying knowledge gaps in emergency tracheostomy management. The findings support a curriculum approach in which students receive repeated opportunities to practice suctioning, cuff-pressure assessment, stoma care, tube management, complication recognition, and emergency response under appropriate supervision.

Conclusion

According to the study's findings, over half of undergraduate nursing students showed just ordinary practical competence, and their knowledge and abilities relating pediatric tracheostomy care were moderate. There was no discernible correlation between the degree of abilities and demographic factors like age and education. To close the gap between theoretical knowledge and clinical practice, our findings emphasize the necessity of improved practical training, simulation-based learning, and expanded clinical exposure. Enhancing tracheostomy care education will eventually increase nursing students' readiness and lead to safer patient outcomes.

Recommendations

- Structured simulation-based training for tracheostomy care, particularly in pediatric settings, should be included in nursing curriculum.
- During clinical rotations, there should be more hands-on clinical exposure to tracheostomy patients.
- Nursing students should participate in regular seminars, refresher courses, and competency-based examinations.
- Retention and confidence in providing tracheostomy care can be improved by including e-learning courses and skill laboratories.
- For a more thorough assessment, future research should include observational skill tests and involve several universities.

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