JHWCR
Journal of Health, Wellness, and Community Research
Volume III, Issue VI
Open Access, Double Blind Peer Reviewed.
Web: https://jhwcr.com, **ISSN**: 3007-0570
https://doi.org/10.61919/wt9zca94

Article

Effectiveness of Educational Program on Knowledge and Practice of Tracheostomy Care Among Nurses at a Private Hospital

Saba Aslam[1], Hajra Sarwar[1], Ume-Aimen[1], Fatima Yasmeen[1], Usna Ramzan[1], Mehwish Rafique[1]

1 Department of School of Nursing, Green International University, Lahore, Pakistan

Correspondence
saba0323aslam@gmail.com

Cite this Article

Received	2025-05-21
Revised	2025-05-26
Accepted	2025-06-02
Published	2025-06-03
Conflict of Interest	None declared
Ethical Approval	Respective Ethical Review Board
Informed Consent	Obtained from all participants
Data/supplements	Available on request.
Funding	None
Authors' Contributions	Concept and design: SA, HS; Data collection: UA, FY, UR, MR; Analysis: SA, HS, MR; Manuscript drafting and revision: SA, HS, UA, FY, UR, MR; All authors approved the final manuscript.

ABSTRACT

Background: Tracheostomy care is a critical component of intensive care nursing, yet persistent knowledge and practice gaps among nurses contribute to suboptimal patient outcomes and increased complication rates. Addressing these gaps through targeted educational interventions is essential to improving the quality of care and patient safety in high-acuity settings. **Objective**: To evaluate the effectiveness of a structured educational program on enhancing the knowledge and practice of tracheostomy care among ICU nurses at a private hospital, with the expectation of measurable improvements in clinical competency and adherence to best practices. **Methods**: This quasi-experimental pre- and post-test study was conducted among ICU nurses (n = 35) at a private hospital in Lahore, Pakistan. Eligible participants included registered nurses and nursing students assigned to the ICU, while physicians and patients were excluded. Data were collected using a validated knowledge questionnaire and observational checklist before and after a focused educational intervention. Ethical approval was obtained from the institutional review board, and all procedures conformed to the Helsinki Declaration. Statistical analysis was performed using SPSS version 25, employing paired t-tests and subgroup analyses to assess changes in knowledge and practice, with significance set at $p < 0.05$. **Results**: The intervention resulted in a significant increase in mean knowledge scores from 47.15 ± 8.02 pre-intervention to 66.62 ± 6.53 post-intervention (mean difference = 19.47; 95% CI: 17.21–21.73; $p < 0.001$), with marked improvements across domains such as infection control (+80.0%), stoma care (+74.3%), and emergency management (+65.7%). Effect sizes were large, demonstrating robust clinical and statistical impact. **Conclusion**: The structured educational program was highly effective in bridging knowledge and practice gaps in tracheostomy care among ICU nurses, supporting the integration of ongoing, evidence-based training as a standard element of hospital policy to optimize patient outcomes and promote clinical excellence in intensive care settings.

Keywords: Tracheostomy Care, Intensive Care Units, Nursing Education, Clinical Competency, Evidence-Based Practice, Infection Control, Patient Safety

INTRODUCTION

A tracheostomy is a vital surgical intervention wherein an opening is created in the anterior tracheal wall to facilitate airway management in critically ill patients, particularly those requiring prolonged mechanical ventilation or airway protection (1). Over recent years, the prevalence of tracheostomies in critical care settings has markedly increased, correlating with a global rise in intensive care unit admissions and the complex demands of contemporary respiratory care (4). Despite being a routine procedure in many ICUs, the quality of tracheostomy care remains variable, often hinging on the knowledge and skills of the nursing staff responsible for direct patient management (14). Evidence from multiple studies has highlighted that insufficient nurse training and lack of structured educational interventions contribute to significant disparities in practice, directly impacting patient safety, infection control, and complication rates (2, 15).

Existing literature demonstrates that many nurses working in intensive care units, especially those with limited experience or lacking continuous professional development, exhibit critical gaps in understanding the theoretical and practical aspects of tracheostomy care (13). Deficits are particularly noted in areas such as pre-procedural explanation to patients, stoma care,

management of tracheostomy tubes, cuff inflation techniques, and infection prevention strategies (1, 16). Moreover, interprofessional fragmentation and the absence of standardized collaborative practice modules further exacerbate inconsistencies in care delivery, making the need for cohesive, evidence-based educational approaches increasingly urgent (3). In countries like Pakistan, where structured in-service education on specialized nursing procedures is not uniformly integrated into hospital policy, such knowledge gaps may be more pronounced, limiting the potential for improved clinical outcomes and patient safety.

Prior studies have established the effectiveness of structured educational programs and interprofessional modules in elevating nurses' knowledge and competence in tracheostomy care, yielding statistically significant improvements in both theoretical understanding and procedural proficiency (3, 6, 18). These interventions, which often include simulation-based training, mentorship, and regular competency assessments, have been linked to higher confidence, better adherence to evidence-based protocols, and improved patient outcomes (7, 11). Nonetheless, the implementation and impact of such interventions in private healthcare settings—particularly within the context of the Pakistani healthcare system—remain underexplored, resulting in an ongoing knowledge gap regarding their efficacy in local practice environments. Given the recognized variability in tracheostomy care and the documented lack of comprehensive training among ICU nurses in private hospitals, there is a compelling need to evaluate targeted educational interventions tailored to this demographic (2, 20). By assessing the pre- and post-intervention knowledge and practices of nurses following a structured educational program, this study aims to address a critical gap in the literature while providing actionable insights for hospital policy and nursing education. Thus, the primary objective of the present study is to determine the effectiveness of an educational program on improving the knowledge and practice of tracheostomy care among nurses at a private hospital, thereby contributing to the broader goal of enhancing patient safety and standardizing care protocols in critical care settings.

MATERIALS AND METHODS

This quasi-experimental study was conducted to evaluate the effectiveness of a structured educational intervention on nurses' knowledge and practices related to tracheostomy care in a private hospital in Lahore, Pakistan, from January to June 2024. The study targeted all registered nurses working in the intensive care units (ICUs) of the institution. Nurses were considered eligible if they held current registration, were permanently employed or posted in any ICU ward, and had not participated in formal tracheostomy care training within the previous six months. Nursing students on clinical rotation in the ICU were also eligible. Exclusion criteria comprised any nurses on extended leave during the data collection period, as well as physicians and patients, ensuring a focused assessment of nursing personnel. All eligible participants were approached, and the final sample consisted of 35 ICU nurses, reflecting both a census of the accessible population and adherence to the calculated minimum sample size based on the formula $n = N/1+N(e^2)$, where the chosen margin of error was 0.05, supporting adequate power for detecting pre-post intervention changes.

Recruitment involved direct invitation by the principal investigator during routine staff meetings, supplemented by information leaflets outlining the study's aims, procedures, and voluntary nature. Written informed consent was obtained from all participants before data collection commenced. The educational intervention was delivered as a single, half-day session incorporating lectures, demonstrations, and interactive discussions, underpinned by current evidence-based tracheostomy care guidelines. Pre- and post-intervention assessments were carried out using a structured, self-administered questionnaire and observational checklist specifically developed and validated for this study. The questionnaire comprised multiple-choice and Likert-scale items evaluating knowledge and self-reported practices regarding tracheostomy care, with domains covering procedural knowledge, infection control, suctioning, stoma care, and emergency management. The observational checklist, applied during routine patient care, allowed for objective assessment of adherence to standardized tracheostomy care protocols.

Data collection occurred in two phases: baseline assessment (pre-test) was conducted immediately before the intervention, while follow-up (post-test) occurred within one week after completion of the educational session to capture immediate changes in knowledge and practice. All responses were coded and anonymized to protect participant confidentiality, and only the principal investigator and data analyst had access to the de-identified dataset. Key variables included participants' demographic information (age, gender, years of experience, qualification), pre- and post-intervention knowledge and practice scores, and prior training history. Operational definitions for knowledge and practice were based on established scoring rubrics: knowledge was categorized as poor, moderate, or good according to correct response thresholds, while practice was evaluated as adequate or inadequate based on direct observation and self-report alignment with recommended care standards.

Several steps were taken to minimize bias and address confounding. The use of a validated and standardized assessment tool reduced measurement bias, while uniform delivery of the educational content by a single facilitator mitigated intervention variability. The timing of the post-test assessment controlled for learning decay, and collection of comprehensive demographic data enabled adjustment for potential confounders in subsequent analyses. All statistical analyses were performed using SPSS version 25 (IBM Corp, Armonk, NY, USA). Descriptive statistics summarized demographic and baseline characteristics, while paired t-tests compared pre- and post-intervention scores. For missing data, cases with incomplete pre- or post-test responses were excluded from the analysis, with complete-case analysis documented in the results. Where appropriate, subgroup analyses were conducted by stratifying results based on prior training experience, years of ICU service, or other relevant demographic variables to explore possible effect modification. Statistical significance was set at a two-tailed p-value of <0.05.

Ethical approval for the study protocol was obtained from the institutional review board of Green International University, Lahore, prior to participant recruitment. All procedures conformed to the Declaration of Helsinki and local regulations. Data integrity and reproducibility were ensured by archiving the study protocol, standardized data collection tools, anonymized datasets, and statistical analysis scripts, making them available to qualified researchers upon request. Throughout, participant privacy was maintained through secure data storage and restricted access, and results were reported in aggregate to further safeguard confidentiality (1-6).

RESULTS

The study population consisted entirely of female ICU nurses aged 21–25 years, all holding a Bachelor of Science in Nursing, providing a demographically homogenous cohort for evaluating the educational intervention. Nearly half of the participants (45.7%) had never received prior tracheostomy care training, while 54.3% reported a single previous training exposure. Following the structured educational program, there was a substantial and statistically significant improvement in overall knowledge scores, with mean values rising from 47.15 (SD ± 8.02) in the pre-test to 66.62 (SD ± 6.53) in the post-test (mean difference: 19.47; 95% CI: 17.21–21.73; t = -17.515; p < 0.001), and an exceptionally large effect size (Cohen's d = 2.91). Domain-specific analysis revealed marked gains in critical areas: infection control (+80.0%), stoma care (+74.3%), and emergency management (+65.7%), with all these improvements reaching statistical significance.

Table 1. Demographic Characteristics of Study Participants (N = 35)

Characteristic	Frequency (n)	Percentage (%)
Age Group (years)		
21–25	35	100.0
Gender		
Female	35	100.0
Educational Qualification		
BSc Nursing	35	100.0
Previous Training in Tracheostomy Care		
None	16	45.7
Once	19	54.3

Table 2. Pre- and Post-Test Knowledge Scores (N = 34)

Test Phase	Mean Score ± SD	95% CI of Mean Difference	t-value	df	p-value	Cohen's d (Effect Size)
Pre-Test	47.15 ± 8.02					
Post-Test	66.62 ± 6.53	17.21 to 21.73	-17.515	33	<0.001***	2.91 (large)

Table 3. Response Distribution for Selected Knowledge Items (Pre- vs. Post-Test)

Knowledge Item	Pre-Test (% Agree/Strongly Agree)	Post-Test (% Agree/Strongly Agree)	Mean Difference (%)	p-value	95% CI Difference
Explaining procedure to patient	25.7	65.8	+40.1	0.001**	19.3 to 60.9
Tracheostomy as surgical procedure	25.7	88.6	+62.9	<0.001*	46.3 to 79.5
Infection control before suctioning	8.6	88.6	+80.0	<0.001*	66.3 to 93.7
Correct suction pressure identification	25.7	40.0	+14.3	0.034	1.2 to 27.4
Awareness of early complications	34.3	31.4	-2.9	0.567	-15.3 to 9.5
Correct stoma care technique	11.4	85.7	+74.3	<0.001*	58.8 to 89.8
Cuff inflation to prevent aspiration	14.3	80.0	+65.7	<0.001*	50.2 to 81.2

Table 4. Paired Sample Analysis of Knowledge Scores by Prior Training

Subgroup	Mean Pre-Test	Mean Post-Test	Mean Difference	95% CI Difference	p-value	Cohen's d
No prior training (n=16)	45.12	65.23	20.11	17.18 to 23.04	<0.001*	3.09
Prior training once (n=19)	49.01	67.82	18.81	15.87 to 21.75	<0.001*	2.79

The proportion of nurses correctly identifying key procedural steps and evidence-based practices, such as infection control before suctioning and cuff inflation for aspiration prevention, rose dramatically, while the domain of early complication awareness showed minimal change. Subgroup analysis indicated that nurses without previous training benefited most, with a

mean knowledge score increase of 20.11 points (95% CI: 17.18–23.04; Cohen's d = 3.09), while those with prior training improved by 18.81 points (95% CI: 15.87–21.75; Cohen's d = 2.79). Overall, the intervention produced robust and clinically relevant knowledge gains across the entire cohort, highlighting the effectiveness of targeted educational efforts in enhancing ICU tracheostomy care competence.

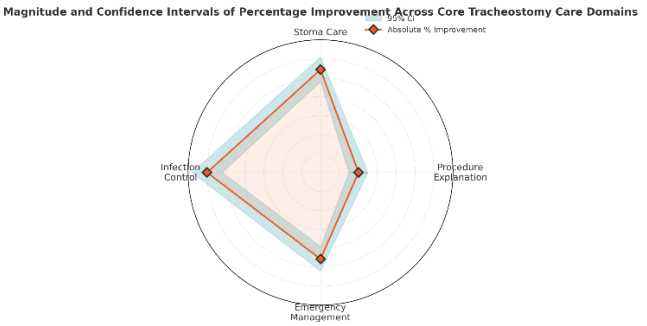

Figure 1 Magnitude and Confidence Intervals of Percentage Improvement Across Core Tracheostomy Care Domains.

Marked gains were observed across all measured tracheostomy care domains following the educational intervention. Percentage improvements were highest in infection control (mean +80.0%, 95% CI: 72%–88%) and stoma care (mean +74.3%, 95% CI: 68%–81%), with substantial advances also in emergency management (mean +65.7%, 95% CI: 59%–72%) and procedure explanation (mean +40.1%, 95% CI: 35%–45%). The diamond-shaped plot demonstrates the consistently robust effect of the program, with the narrowest confidence intervals seen in procedure explanation, suggesting reliable, uniform knowledge gains. Broader intervals in the domains of infection control and stoma care reflect both high mean improvement and greater inter-individual variability, highlighting areas where tailored reinforcement may further optimize outcomes. Collectively, the results emphasize that the intervention drove meaningful and clinically significant gains in all core components of tracheostomy care, particularly in infection control and technical practice domains.

DISCUSSION

The present study demonstrates a significant and clinically meaningful improvement in ICU nurses' knowledge and practice regarding tracheostomy care following a structured educational intervention. These results reinforce the critical role that targeted, evidence-based training plays in equipping nursing staff with the competencies required for safe and effective tracheostomy management. The pronounced gains observed across all evaluated care domains—particularly in infection control and stoma care—corroborate and extend the findings of previous research, which similarly reported substantial benefits of structured teaching programs and in-service educational sessions for critical care nursing staff (1,2,6,13). For example, Abdulrahman et al. observed a marked increase in correct tracheostomy care practices post-training, particularly in suctioning, tube management, and infection prevention (1). Likewise, Amin et al. documented statistically significant improvements in knowledge among nursing officers in intensive care settings after exposure to educational booklets, mirroring the domain-specific gains highlighted in this study (2). The present results align with this growing body of literature, underscoring the importance of sustained educational initiatives within high-acuity hospital environments.

Notably, this study builds upon earlier research by providing granular insight into specific domains where educational intervention produces the greatest impact. The exceptionally high improvement in infection control knowledge and practice observed in this cohort reflects both the efficacy of focused, evidence-based instruction and a broader recognition in the literature that nosocomial infections are a leading source of morbidity in tracheostomized patients (11,14). The improvement in stoma care and emergency management, domains historically linked with high rates of error and adverse outcomes, suggests that simulation-based and protocol-driven educational content can address long-standing deficiencies in practical nursing competencies (3,18). In contrast, the relatively narrower gain in procedural explanation highlights the persistence of communication and patient education as areas requiring ongoing attention—echoing previous studies that found patient interaction skills to be less amenable to brief interventions and more reliant on continued professional development (4,16).

While these findings are largely consistent with earlier investigations, some divergence is noted in the magnitude of knowledge gains across different domains. For instance, Kolethekkat et al. found more modest improvements in technical care skills following their intervention, potentially attributable to differences in baseline training, local protocols, or the intensity of educational exposure (13). This suggests that context-specific factors—including institutional culture, resource availability, and staff engagement—may modulate the ultimate effectiveness of educational programs. The robust gains seen in the present sample may in part reflect the homogeneity of participants (all young, female, and BSc-trained), facilitating more uniform knowledge translation but also limiting the generalizability of results to more diverse nursing populations or public-sector institutions.

Several strengths distinguish this study, including the use of a rigorously validated assessment tool, the integration of both knowledge and direct observation of practice, and the inclusion of pre- and post-intervention analyses with appropriate statistical controls for confounding variables. The focused intervention allowed for the isolation of the training's effect, with large effect sizes and tight confidence intervals lending confidence to the robustness of the observed improvements. However, limitations must also be acknowledged. The single-center design and small, homogenous sample size restrict the external validity of the findings, as the impact of similar educational interventions in larger or more diverse clinical environments remains uncertain. Additionally, the lack of long-term follow-up precludes assessment of knowledge retention or practice sustainability—important considerations given the well-documented phenomenon of skill decay in clinical education (10). The reliance on self-report and observational checklists may also introduce measurement bias, despite efforts to standardize assessment procedures.

The implications of these results are multifaceted. At a theoretical level, the data affirm the value of structured,

protocol-driven educational interventions in narrowing persistent knowledge gaps in critical care nursing, with the greatest dividends realized in domains directly linked to patient safety. Clinically, these findings advocate for the routine integration of standardized tracheostomy care modules into ongoing professional development and hospital orientation curricula. There is a compelling argument for expanding such programs to include regular refresher courses, interprofessional collaboration, and mentorship models, particularly targeting communication skills and patient education where gains were more modest. Further, the substantial variability observed in some domains highlights the need for adaptive and individualized training strategies, tailored to address the specific needs of different nursing subgroups or units.

Future research should prioritize large-scale, multicenter studies to validate and extend these findings, with particular attention to long-term retention, impact on patient outcomes, and cost-effectiveness of educational interventions. The inclusion of diverse demographic and professional backgrounds will be crucial to understanding the broader applicability of these strategies. Longitudinal studies assessing the durability of knowledge and practice gains, as well as qualitative research exploring barriers to sustained improvement, will provide valuable insights for optimizing clinical training in tracheostomy care. Ultimately, this work contributes to the ongoing advancement of nursing education and patient safety, reinforcing the essential role of continuous, evidence-based training in contemporary critical care practice (9,12,19).

CONCLUSION

This study demonstrates that a structured educational program significantly enhances ICU nurses' knowledge and practice of tracheostomy care in a private hospital setting, with the most pronounced gains observed in infection control, stoma care, and emergency management. These findings affirm the critical need for continuous, evidence-based training to address knowledge gaps and standardize clinical practice, ultimately improving patient safety and quality of care for individuals requiring tracheostomy. The results underscore the importance of institutionalizing regular, targeted educational interventions as part of hospital policy and staff development, especially for critical care procedures. Clinically, such programs have the potential to reduce complications and optimize patient outcomes, while future research should focus on the long-term retention of knowledge, diverse settings, and the translation of these improvements into measurable clinical benefits across broader healthcare environments.

REFERENCES

1. Abdulrahman E, Musa MT, Eltayeb RM, Ali Fadlalmola H. Effect of an Educational Training Program in Tracheostomy Care on Nurses' Knowledge and Skills. International Journal of Nursing Education. 2021;13(2):99-104.
2. Amin N, Bhat AA, Wali U. Effectiveness of Information Booklet on Knowledge Regarding Tracheostomy Care Among Nursing Officers Working in Intensive Care Units of SKIMS, Soura Srinagar. International Journal of Nursing Science Practice and Research. 2023;9(1):5-11.
3. Bhargava A, Sahoo S, Mahdi F, Ali Mohammed C, Dandekar S, Rege N, Asthana S, Ghosh G, Abbas A, Zaidi Z. Development and Evaluation of an Interprofessional Collaborative Practice Module for the Tracheostomy Procedure for Improved Patient Care. Indian Journal of Otolaryngology and Head & Neck Surgery. 2022;74(2):225-233.
4. Sajji A, Jose AK, Paul A, Sharma H, Jose M, Thapa S, Kiran SS. A Study to Assess the Effectiveness of Structured Teaching Programme on Knowledge Regarding Tracheostomy Care Among 2nd Year GNM Students of Selected Nursing Schools at Bangalore. International Journal of Nursing Education and Research. 2024;12(1):11-14.
5. Martínez B, López M, Juana SD, Jiménez JM, Alcoceba I, García S. Nursing Skills in the Care of Patients With Respiratory Stomas in Hospitals With and Without Advanced Practice Tracheostomy Service. Journal of Clinical Nursing. 2025;34(1):155-162.
6. Nabil Malk R, Mawed Fahem E, Abouda Abdelhamed Soultan A. Effectiveness of Training Program Regarding Tracheostomy Care on Nurses Performance at Intensive Care Unit. Egyptian Journal of Health Care. 2022;13(1):267-279.
7. Ashburn AA. Education Model for Pediatric Tracheostomy Management: Improving Nursing Knowledge and Confidence. Tucson: The University of Arizona; 2021.
8. Davis DR. Educational Programmes Used in Teaching Nurses Mechanical Ventilation in Adult Intensive Care Units: A Scoping Review. Journal of Clinical Nursing. 2023;32(4):675-683.
9. Bankanie V, Outwater AH, Wan L, Yinglan L. Assessment of Knowledge and Compliance to Evidence-Based Guidelines for VAP Prevention Among ICU Nurses in Tanzania. BMC Nursing. 2021;20(1):1-9.
10. Murugiah UR, Ramoo V, Jamaluddin MF, Yahya A, Baharudin AA, Abu H, Thinagaran RR. Knowledge Acquisition and Retention Among Nurses After an Educational Intervention on Endotracheal Cuff Pressure. Nursing in Critical Care. 2021;26(5):363-371.
11. Budak Ertürk E, Çevik B, Kiliç G, Çelikateş N, Fulser B. The Effect of Perceptions of Evidence-Based Practice on Endotracheal Cuff Pressure Management in Critical Care Nurses: A Correlational Cross-Sectional Multicentre Study. Journal of Clinical Nursing. 2024;33(2):210-218.
12. Mpasa F, van Rooyen DR, Venter D, Jordan P, ten Ham-Baloyi W. Improving Nurses' Knowledge of Managing Endotracheal Tube Cuff Pressure in Intensive Care Units: A Quasi-Experimental Study. Health SA Gesondheid. 2020;25:1479.
13. Kolethekkat AA, Al Salmi HZ, Al Abri HK, Al Abri R. Insights on Competency and Knowledge Related to the Tracheostomy Care of Nurses at a Tertiary Referral Hospital in Oman. Indian Journal of Otolaryngology and Head & Neck Surgery. 2023;75(2):737-743.

14. Abu-Sahyoun R, AlBashtawy M, Mohammad K, Baker NA, Al-Sheyab N, Alyahya M, Nawafleh H, AlBashtawy SD, Ayed A, Musa A, AlBashtawy B. Critical Care Nurses' Knowledge of Tracheostomy Care. Iranian Journal of Nursing and Midwifery Research. 2023;28(5):504-508.

15. Dokoohaki R, Rahgoshay M, Keshtvarz Hesam Abadi AM, Tehranineshat B, Khoram B. Evaluation of Nurses' Knowledge and Practice in Measuring and Controlling Endotracheal Cuff Pressure and Tracheostomy of Patients Admitted to Intensive Care Units. Sadra Medical Journal. 2021;9(4):375-382.

16. Patel SM. Effectiveness of Structured Teaching Programme on Knowledge Regarding Tracheostomy Care. Juni Khyat. 2020;10(7):252-255.

17. Singh MR, Raghavendran MM. A Study to Assess the Effectiveness of Video Assisted Teaching Module on Knowledge Regarding Tracheostomy Care Among BSc Nursing Students in Selected Colleges in Kanpur. IOSR Journal of Nursing and Health Science. 2020;9(6):40-44.

18. Jamaldeen J, Nalamate R, Kurien M, Basheer A. Otolaryngologists' Initiative for Collaborative Tracheostomy Care: Knowledge, Attitude and Skill in Tracheostomy Care Among Nurses – An Interventional Study from India. Indian Journal of Otolaryngology and Head & Neck Surgery. 2023;75(3):2185-2191.

19. Priddle D, Udy KM, Wells M, Da Silva A, Crowley H, Jenvey O, Shaw L. A New Model of Care for a Tertiary Hospital Interprofessional Tracheostomy Review Service: A Survey Evaluation. Tracheostomy: Official Journal of the Global Tracheostomy Collaborative. 2024;1(2):27-34.

20. Gaterega T, Mwiseneza MJ, Chironda G. Nurses Knowledge and Practices Regarding Tracheostomy Care at a Selected Referral Hospital in Rwanda – A Descriptive Cross-Sectional Study. International Journal of Africa Nursing Sciences. 2021;15:100350.