



Otolaryngologists' Initiative for Collaborative Tracheostomy Care: Knowledge, Attitude and Skill in Tracheostomy Care Among Nurses - An Interventional Study from India

Jishana Jamaldeen¹ · Rajarajeswari Nalamate² · Mary Kurien³ · Aneesh Basheer⁴ · Rose⁵

Received: 8 February 2023 / Accepted: 3 March 2023 / Published online: 6 May 2023
© Association of Otolaryngologists of India 2023

Abstract

Introduction: Tracheostomy-related adverse events are a global problem, requiring coordinated approach for care of tracheostomised patients. The concept of 'collaborative tracheostomy care' was introduced by Global Tracheostomy Collaborative in 2012. For successful post tracheostomy outcome, nursing care is vital. Data on their knowledge, attitude and skills regarding tracheostomy care including outcome of a structured interventional workshop is not available from India. **Methods:** A validated questionnaire with items pertaining to knowledge, attitude and skills regarding tracheostomy care was administered to nurses working in intensive care units and wards. Following this, a workshop was conducted for hands-on training in tracheostomy care using didactic lectures, videos and simulation-based training. The participants took a post-test immediately and after three months. Skills were assessed before and three months after the workshop using a checklist. **Results:** Among 386 participants who attended the pre-test and workshop, 285 (74.2%) underwent post-test immediately and three months later. Overall mean knowledge score (\pm SD) of the participants in pre-workshop was 6.8 ± 3.5 , immediate post-test score was 15.9 ± 2.7 and three months later was 11.6 ± 3.5 ($p < 0.001$) out of total score 20. The baseline score was significantly higher among ICU nurses. Three months post workshop skill assessment revealed no statistically significant increase in the proportion of participants who performed skills related to suctioning procedure. **Conclusion:** Knowledge, attitude and practice regarding tracheostomy care is inadequate among nurses. Otolaryngologists-driven structured intervention with didactic lectures, videos and hands-on training can improve all three domains to positively impact outcomes in post tracheostomy patient care.

Keywords Tracheostomy care · Knowledge · Skills · Practice · Education

Introduction

Improved tracheostomy care initiatives though present for more than a decade, best practices have yet to be standardized universally. The Global Tracheostomy Collaborative is dedicated to improving tracheostomy care. The five key 'drivers' identified to improve services are multidisciplinary synchronous involvement, interdisciplinary education with staff allocation, care protocol standardization, patient with family involvement and use of data [1, 2].

Tracheostomy is a common surgical procedure in critically ill patients. Post tracheostomy care is vital as potential life-threatening complications like tube block, displacement, accidental decannulation including bleeding can be prevented by care, timely recognition and intervention. Although tracheostomy is performed by Otolaryngologists,

✉ Jishana Jamaldeen
jishana.j@gmail.com

¹ Department of ENT, Dr Moopen's Medical College, Wayanad 673577, Kerala, India

² Department of ENT, Pondicherry Institute of Medical Sciences, Puducherry, India

³ Department of ENT, Pondicherry Institute of Medical Sciences, Puducherry, India

⁴ Department of General Medicine, Dr Moopen's Medical College, Wayanad, India

⁵ College of Nursing, Pondicherry Institute of Medical Sciences, Puducherry, India

Table 1 Knowledge questions in the questionnaire

Sl. No.	Questions (marks)
1	Worrisome complications post tracheostomy (2)
2	Types of tracheostomy tube (2)
3	Indications for cuffed tracheostomy tube (2)
4	Function of cuff (1)
5	Ideal time for 1st tube change if not blocked (1)
6	How to identify if cuff is inflated? (1)
7	How often to deflate the cuff (1)
8	Duration of cuff deflation (1)
9	Reason to deflate the cuff (1)
10	Ideal size of suction catheter to be used (1)
11	Frequency of suctioning (1)
12	Length of suction catheter to be inserted (1)
13	Solutions used prior to suctioning (2)
14	Precautions to be taken before feeding tracheostomised patient (3)

the postoperative period is spent in ICU or in general wards where nursing staff are the caregivers of continuing contact. Several studies conducted in different parts of world reveal lack of confidence, knowledge and skills among nurses dealing with tracheostomised patients [1, 3, 4]. There is no standardized education program related to tracheostomy care in the nursing curriculum, thus leading to their knowledge of tracheostomy care below expectations [5]. Lack of adequate knowledge and skills regarding the anticipated complications and the interventions to prevent and/or detect them among caregivers contribute to increased rates of these complications, particularly when patients are transferred from intensive care units to general care areas [6, 7]. Studies on knowledge, skills and attitudes regarding tracheostomy and post-tracheostomy care are limited in India [4].

Table 2 Checklist for assessment of skills and practice of tracheostomy care

Sl. no.	Steps	Marks
1.	Checks whether spare tube of same size is available at bedside [1]	
2.	Checks approximate length of suction catheter with spare tube [1]	
3.	Uses appropriate size catheter for suction [1]	
4.	Selects/uses appropriate solution prior to suction [1]	
5.	Temporarily closes limb of Y connector during insertion of suction catheter [1]	
6.	Performs suctioning using rotating movements [1]	
7.	Checks for air blast following completion of suction [1]	
8.	Global rating score* [3]	
	Total score [10]	

*Global rating score signifies a holistic rating of the overall procedure by the assessor. Participants will receive scores of 0, 1, 2 or 3 for this item based on the following criteria:

- 3 – completes all steps confidently and sequentially within acceptable time limit.
- 2 – completes most of the steps sequentially within acceptable time limit; misses two or fewer steps.
- 1 – does not complete the steps within acceptable time limit; misses more than two steps.
- 0 – not able to perform steps in sequence, inappropriately long time.

Numbers in square brackets indicate marks for each step.

The purpose of this study was to assess the baseline knowledge, attitude and skills (practice) of nurses about tracheostomy care in our institution and to establish whether conducting a workshop on tracheostomy care could improve these with overall confidence in managing post tracheostomy patients.

Methodology

Nurses working in wards and intensive care units at our centre which is a tertiary care academic institution in southern India were included in the study. Following approval by Institute's Research and Ethics committee (IEC: RC/19/59) and obtaining informed written consent, an assessment of their baseline knowledge and attitude regarding tracheostomy care was done with a help of a questionnaire (Table 1). Questionnaire was developed using items from similar instruments described in literature adapted to local needs and content was validated by two external experts who piloted on staff nurses and postgraduates at a reputed tertiary hospital in India.

Baseline skills and practice were checked by direct observation on a subset of the participants using a checklist developed for the same (Table 2). Following baseline assessment, the participants underwent workshop on tracheostomy care as lectures and interactive sessions which included the basic principles of tracheostomy care, problems to be anticipated following tracheostomy and information on how to deal with them. The workshop also imparted hands-on training in tracheostomy care (ideal method as well as frequency of suctioning, method of deflating the cuff, tracheostomy

Fig. 1 Skill workshop equipment

Low cost model used for skills enhancement: Tracheostomy care

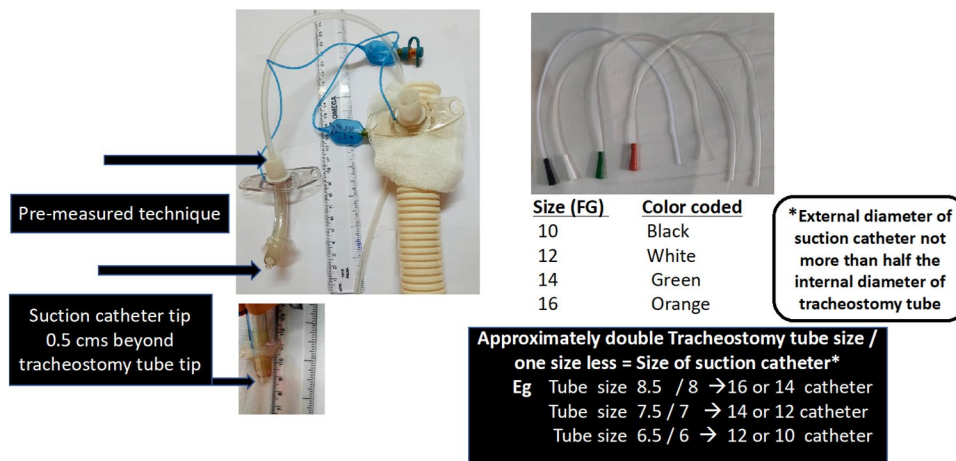
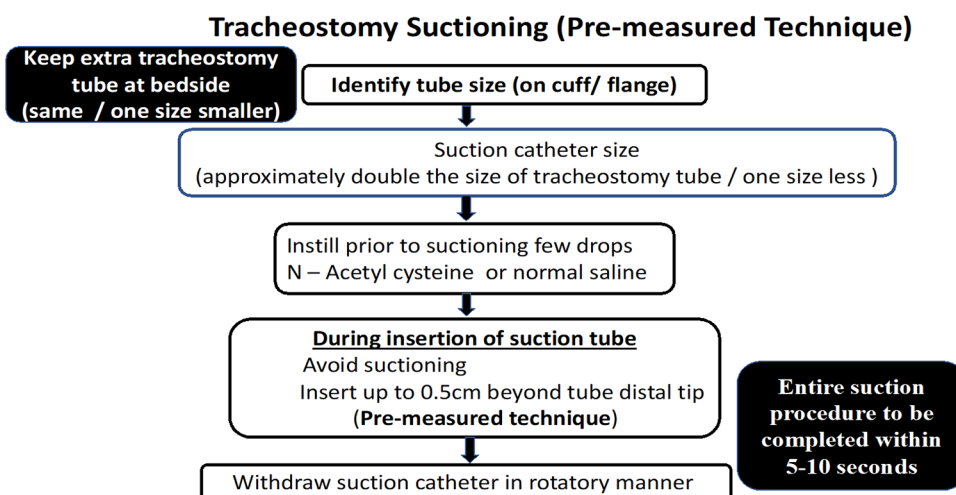


Fig. 2 Tracheostomy suction protocol



wound care, measures for humidification and interventions in the event of tube block or displacement). Faculty from department of ENT facilitated the workshop. The participants were trained in groups of twenty per session lasting two hours. Post-test was administered using the same questionnaire to determine the effectiveness of the workshop on knowledge and attitudes immediately as well as three months later. Improvement in skills and practice was determined using the same checklist for observation after three months. Feedback was also obtained from the participants after the workshop.

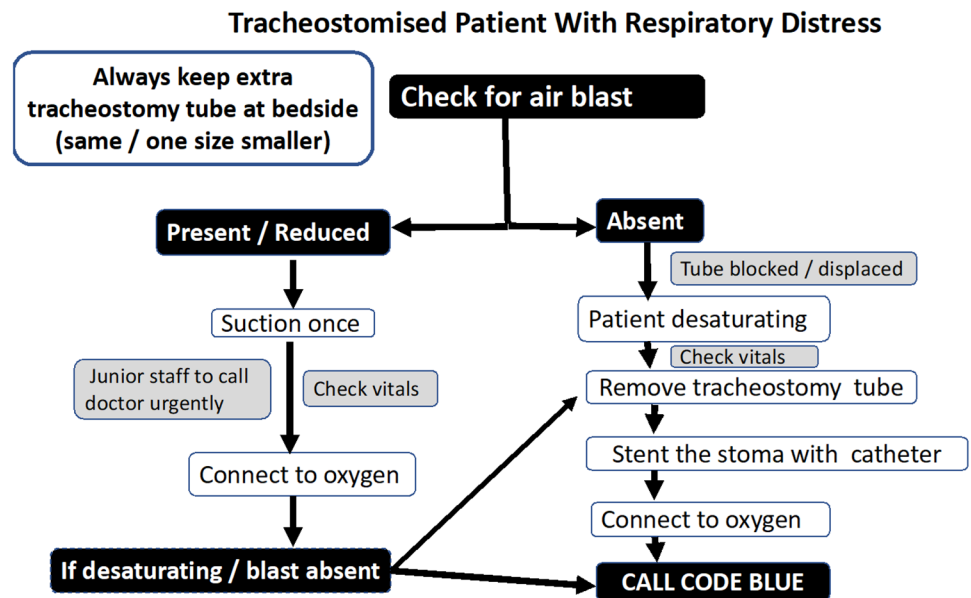
Sample Size Assuming a 20% improvement in scores of knowledge, attitude and skills following the intervention, with an alpha error of 5% and power of 80% we estimated the sample size as 104. However, all consenting nurses

working in wards and ICUs at the institution were included in the study for training.

Data regarding baseline knowledge, attitude and skills were represented as means with standard deviation. Change in mean scores before and after the workshop was compared using paired t test. Satisfaction and self- perceived increase in confidence were represented as proportions with confidence intervals. Post-tracheostomy complications were also described as proportions and compared using Chi-square test. p value less than 0.05 was considered statistically significant for all comparisons.

Main points of consideration with the materials used for workshop are given in Fig. 1. At the end of the workshop hand-outs along with flow chart for tracheostomy suction and a protocol for management of tracheostomized patient with respiratory distress as shown in Figs. 2 and 3 respectively were shared with the participants.

Fig. 3 Acute Airway management

**Table 3** Mean pre-test, immediate post-test and late post test scores of participants with regards to knowledge (n=285)

S.no	Nurses working area	Pre-test score (SD)	Immediate test score (SD)	Three months test score (SD)
1	ICU	8.7 (4.0)	17.0 (2.5)	13.2 (3.6)
2	Medical	6.4 (3.1)	15.7 (2.8)	11.7 (3.2)
3	Surgical	5.9 (3.0)	15.3 (2.6)	10.4 (3.3)

Results

The workshop was attended by 386 participants, who underwent a pre-test and immediate post-test. Among this, 285 (74.2%) attended the post-test conducted three months later. Of these 285 participants 76 (26.7%) were working in ICU, 101 (35.4%) in medical wards and 108 (37.9%) in surgical wards. Participants were categorised based on experience into less than or equal to 12 months (n=73), 13–36 months (n=123) and more than 36 months (n=89). Questionnaire (Appendix 1) contained 14 questions on knowledge (20 marks), 4 attitude questions, practice questions and one general question.

Knowledge Assessment

Overall mean knowledge score (\pm SD) of the participants out of 20 in preworkshop was 6.8 ± 3.5 , immediate post-test score was 15.9 ± 2.7 and 3 months later was 11.6 ± 3.5 ($p < 0.001$). The mean scores at baseline, immediate post-test and at 3 months among nurses in different work areas in shown in Table 3.

ICU nurses were found to have better knowledge ($p < 0.001$) as compared to medical and surgical ward nurses. Following the workshop, all three groups of nurses demonstrated statistically significant increases in knowledge (Fig. 4). The mean increase from baseline to immediate post-test was 8.3, 9.3 and 9.4 respectively among ICU, medical and surgical ward nurses.

One hundred and one participants did not attend the three months post-test. Among the participants, pre-test mean score was 6.7 ± 2.8 and immediate post test score was 15.8 ± 2.7 . Minimum mark was one and maximum was nine in pre-test whereas post-test the minimum mark was nine and maximum was 20 marks. This was statistically significant.

Attitude Assessment

88% of nurses agreed at baseline that tracheostomy care should be part of their training program while 93% and 90.9% had this opinion on immediate and three months post-test respectively.

There was statistically significant increase in the proportion of participants who responded correctly to attitude related questions (Table 4).

Skill (Practice) Assessment

Skill assessment was done on 50 nurses randomly from various wards by using a checklist preworkshop and 3 months post workshop. There were improvements noted in first 4 steps of the checklist post-workshop. However, there was

Fig. 4 Comparison of mean knowledge scores among nurses

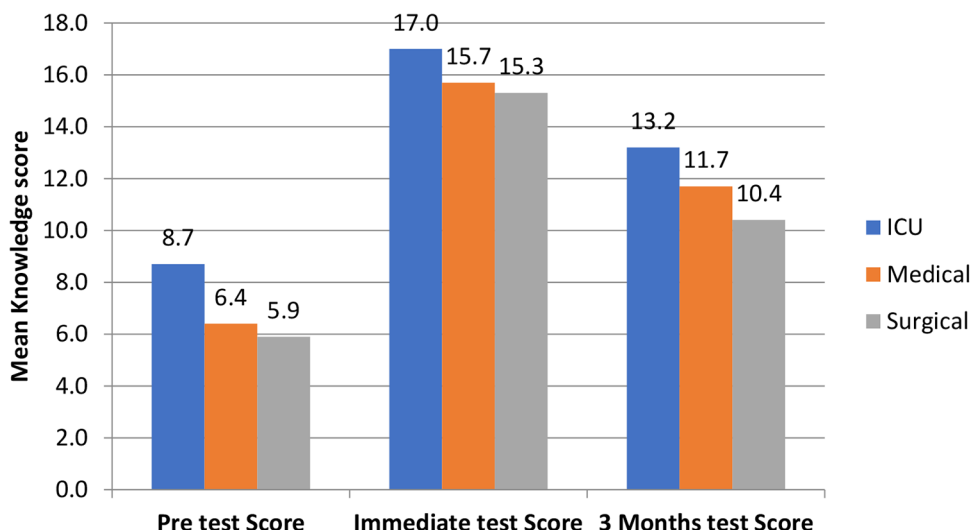


Table 4 Proportion of participants who scored correct on attitude questions in preworkshop, immediate and three months post workshop

Attitude scenario	Appropriate response at baseline	Appropriate response at immediate post-test	Appropriate response at three months	P value
A1	162 (75.3)	174 (80.9)	171 (79.5)	0.01
A2	125 (68.3)	146 (79.8)	112 (61.2)	<0.001
A3	98 (86.7)	109 (96.5)	110 (97.3)	<0.001
A4	141 (86.5)	161 (98.8)	156 (95.7)	<0.001

(Note: Numbers in brackets are percentages; A1 to A4 are detailed in annexure 1)

no statistically significant increase in the proportion of participants who performed the later 3 steps (primarily related to suctioning procedure) following the workshop (Table 5).

Discussion

Though tracheostomy is done by Otolaryngologists, ongoing nursing care is vital. For transfer of continuity in tracheostomy care, knowledge and optimum skills to practice safe and successful post procedural care is essential. Our

study assessing knowledge, attitudes, and practices regarding tracheostomy care in a cohort of nurses at a tertiary care hospital from southern India, demonstrated poor scores in knowledge and skill domains at baseline. Nurses posted in ICU had better scores in these two domains compared to those working in other care areas. Significant gaps were found in knowledge among health care professionals in managing tracheostomy related complication [6–8]. These findings parallel our results, although we focused primarily on nurses.

Some studies analysed knowledge among subgroups based on experience, private or public hospitals and gender. Maximum scores were obtained by nurses with experience of 1–3 years [8] and more than 5 years of paediatric experience [3], while Sharma et al from India noted that male nurses, those working in private hospitals and those with long ICU experience had better knowledge of tracheostomy care [4]. Although we noted better scores at baseline in ICU nurses, there was no similar association with experience and gender.

Majority of published studies have focused on either one domain or one aspect of practice. A questionnaire-based knowledge and ‘comfort level’ revealed a significant

Table 5 Number of participants who scored one in each of the skill components (pre and post workshop)

S.no	Skill component	Preworkshop	Postworkshop	P value
1.	Checks whether spare tube of same size is available at bedside [1]	0	14	<0.001
2.	Checks approximate length of suction catheter with spare tube [1]	0	16	<0.001
3.	Uses appropriate size catheter for suction [1]	6	25	<0.001
4.	Selects / uses appropriate solution prior to suction [1]	9	35	<0.001
5.	Temporarily closes limb of Y connector during insertion of suction catheter [1]	21	29	0.135
6.	Performs suctioning using rotating movements [1]	32	37	0.356
7.	Checks for air blast following completion of suction [1]	0	4	0.118

Number in square bracket – score for each step.

Pre-workshop mean score 2.2, SD 1.8, Median 2.5, IQR 0–3.3, minimum 0, maximum 6.

Post-workshop mean score 4.6, SD 2.7, Median 5.0, IQR 3–6, minimum 0, maximum 1.

positive correlation with tracheal care and academic degree, duration of paediatric experience and completion of more than one life support course [3]. Similarly, a questionnaire-based knowledge and competency revealed low scores among nursing care providers [1]. Certain investigators assessed knowledge regarding tracheostomy care among specific groups of nurses. Knowledge related to tracheostomy care among ICU nurses and found it satisfactory only in 46.4% [5]. In some studies, individual knowledge components had been assessed. Participants scored lowest on questions related to cuff pressure, suction pressure and first response to tube block [8]. In contrast, our study used a comprehensive questionnaire assessing all three domains; knowledge, practice and attitudes in all nurses, irrespective of their inpatient work areas and compared them between subgroups including ICU, medical and surgical wards. This analysis revealed that although baseline scores of knowledge, attitude and skill were low in all nurses, those working in ICU performed much better than others.

Diverse interventions such as evidence-based knowledge and hands on skill training with certification as tracheostomy care nurses [9], a combination of informative posters, anatomic diagrams and didactic lectures by the bedside of patients [10], using online tutorials and hands on training [7] and simulation based training [11] have been used by investigators to improve tracheostomy care related competencies. We used a combination of didactic interactive small group sessions with videos followed by hand on training in small groups. Following the session, resource persons ensured that each participant independently and individually performed all steps of tracheostomy care satisfactorily while giving constructive feedback. Handouts were provided at the end of the training with the intention of revision and retention of competencies.

In our study, outcomes of the intervention were assessed immediately after the training and three months later. Following a hands-on workshop, these scores improved considerably, irrespective of the area of work. Though there was a dip in the scores at three months following the workshop, the scores remained significantly higher than baseline.

In most studies, authors determined change in knowledge and/or skills immediately after the training [6, 8, 12]. Like our study, retention was noted at six months in a publication which had included only physician trainees and not nurses [11]. In our study, analysis of skill domain revealed interesting findings. We noted that no participant performed the initial two steps of tracheostomy care including checking for availability of spare tracheostomy tube by the bedside and checking the approximate length of suction catheter using the spare tube. However, following training, there was statistically significant improvement in nurses who performed these steps. Similarly, there were statistically significant

increases in nurses who used appropriate size of suction catheter and solution for tracheostomy care following the training. To the best of our knowledge, these individual crucial components have not been assessed in other studies [12, 13].

It is therefore important that future studies address long term retention of knowledge and skills. Further, findings from our study suggest that periodic reinforcement trainings may be needed to maintain the competencies gained.

Strength and Limitations

We were able to achieve a large sample size and conduct this study on all consenting nurses and train individual nurses by a hands on workshop and assess their retainment of knowledge at their workplace.

However, due to the COVID 19 pandemic three months post knowledge and skill assessment could not be done on all nurses due to high attrition hindering our study.

Conclusion and Clinical Significance

This study reiterates the knowledge and skills among nurses who are vital for ongoing safe tracheostomy care. In addition, it is a high-stake competency with its retention waning over time. The operating surgeon, Otolaryngologist's, role in overcoming this lacuna is the way forward. Periodic reinforcement with a well-structured intervention training using didactic small group sessions for knowledge and hands-on skill training for improving their tracheostomy-care competencies are essential. This would go a long way in preparing our nursing fraternity to face challenges related to tracheostomy care and patient safety.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s12070-023-03682-9>.

Author Contribution Study concept, design - Dr Jishana, Dr Rajeswari, Dr Aneesh Basheer, Dr Rose
 Analysis and Interpretation of data - Dr Jishana, Dr Rajeswari
 Drafting of Manuscript - Dr Jishana, Dr Mary Kurien, Dr Aneesh Basheer
 Critical revision of manuscript for important intellectual content - Dr Mary Kurien, Dr Rose
 Literature research and analysis- Dr Mary Kurien, Dr Aneesh Basheer
 Statistical analysis- Dr Aneesh Basheer
 Study supervision- Dr Mary Kurien, Dr Rose

Funding The authors did not receive support from any funding agencies for the submitted work.

Declarations

Competing interests The authors have no financial or non-financial interests to disclose.

References

- Kolethekkat AA, Al Salmi HZ, Al Abri HK, Al Abri R (2023) Insights on Competency and Knowledge Related to the Tracheostomy Care of Nurses at a Tertiary Referral Hospital in Oman. *Indian J Otolaryngol Head Neck Surg* [Internet]. Jan 9 [cited 2023 Feb 1]; Available from: <https://doi.org/10.1007/s12070-022-03433-2>
- Global Tracheostomy Collaborative : data-driven improvements in patient safety through multidisciplinary teamwork, standardisation, education, and patient partnership - PubMed [Internet]. [cited 2023 Feb 1]. Available from: <https://pubmed.ncbi.nlm.nih.gov/32456776/>
- Mosalli R, Aboumoustafa GA, Khayyat W, Bokhari AN, Almatrafi MA, Ghazi M et al (2022) Assessment of Nurses' knowledge and confidence regarding Tracheostomy Care in a Pediatric Long Term Care Hospital in Saudi Arabia. *Risk Manag Healthc Policy* 15:1809–1821
- Varshney S, Sharma SK, Jelly P, Tracheostomy S (April 2017) Exploration of Knowledge and Practices of Nurses Working in selected Tertiary Care Hospitals in Uttarakhand State. *Nurs Midwifery Res J* –13(2):68–77
- Mungan İ, Kazancı D, Bektaş Ş, Sarı S, Çavuş M, Turan S (2019) The evaluation of nurses' knowledge related to tracheostomy care in tertiary intensive care units. *Int Med* 1(6):313
- Cassery P, Lang E, Fenton JE, Walsh M (2007 Sep) Assessment of healthcare professionals' knowledge of managing emergency complications in patients with a tracheostomy. *Br J Anaesth* 99(3):380–383
- McDonough K, Crimlisk J, Nicholas P, Cabral H, Quinn EK, Jalisi S (2016 Nov) Standardizing nurse training strategies to improve knowledge and self-efficacy with tracheostomy and laryngectomy care. *Appl Nurs Res ANR* 32:212–216
- Khanum T, Zia S, Khan T, Kamal S, Khoso MN, Alvi J et al (2021) Assessment of knowledge regarding tracheostomy care and management of early complications among healthcare professionals. *Braz J Otorhinolaryngol* [Internet]. Aug 6 [cited 2022 Feb 5]; Available from: <https://www.sciencedirect.com/science/article/pii/S180886942100135X>
- Sodhi K, Shrivastava A, Singla MK Implications of dedicated tracheostomy care nurse program on outcomes. *J Anesth*. 2014 Jun 1;28(3):374–80
- DeVictor S, Ong AA, Kelly AP, Burke MS (2020 Dec) Postoperative management after Tracheostomy and Laryngectomy: improving nursing knowledge with Bedside posters. *OTO Open* 4(4):2473974X20971185
- Davis KA, Edgar-Zarate CL, Bonilla-Velez J, Atkinson TN, Tulunay-Ugur OE, Agarwal A (2019 Dec) Using Didactics and Simulation to Enhance Comfort, Knowledge, and skills of nonsurgical trainees caring for patients with tracheostomy and laryngectomy. *Simul Healthc J Soc Simul Healthc* 14(6):384–390
- Hart P, Eaton L, Buckner M, Morrow BN, Barrett DT, Fraser DD et al (2008) Effectiveness of a computer-based Educational Program on Nurses' knowledge, attitude, and Skill Level related to evidence-based practice. *Worldviews Evid Based Nurs* 5(2):75–84
- Labrague LJ, McEnroe-Pettite D, Tsaras K, D'Souza MS, Fronda DC, Mirafuentes EC et al (2019) Predictors of evidence-based practice knowledge, skills, and attitudes among nursing students. *Nurs Forum (Auckl)* 54(2):238–245

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.