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The impact of self-care deficits and infection control among patients with tracheostomies in intensive care unit: A scoping review

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Abstract

Background: Patients in intensive care units (ICUs) with tracheostomies are particularly susceptible to nosocomial infections, notably ventilator-associated pneumonia (VAP) and lower respiratory tract infections. A key contributing factor is the presence of self-care deficits, as these patients are generally unable to maintain airway hygiene or perform tracheostomy wound care independently. These deficits are compounded by healthcare worker workload, constrained ICU resources, and the absence of standardized care protocols. A comprehensive synthesis of existing evidence is therefore necessary to clarify the relationship between self-care deficits and infection risk.

Purpose: To explore and analyze the association between self-care deficits and infection incidence in ICU patients with tracheostomy, with a focus on identifying key risk factors, implementation challenges, and effective infection prevention strategies.

Method: A systematic literature search was conducted using databases including ProQuest, JSTOR, BMC, and Google Scholar, covering studies published between January 2015 and December 2024. Of 1,157 articles initially identified, 35 were selected for full-text review based on predefined inclusion and exclusion criteria. Quality appraisal was conducted using the Joanna Briggs Institute (JBI) framework, yielding 11 articles for final inclusion.

Results: Self-care deficits substantially contribute to nosocomial infection risk in ICU patients with tracheostomies. Identified risk factors include ineffective secretion management, poor oral hygiene, and improper suctioning techniques. Inadequate education for both patients and caregivers following ICU discharge further exacerbates this risk. Additional barriers include limited medical equipment availability, insufficient training in tracheostomy wound care, and healthcare provider burden. Furthermore, there is a lack of research addressing the long-term consequences of self-care deficits and the effectiveness of patient-centered educational interventions.

Conclusion: Self-care deficits significantly elevate the risk of infection among ICU patients with tracheostomies, primarily due to impaired hygiene and secretion management. Contributing factors include insufficient resources, absence of standardized protocols, and limited educational support for patients and caregivers. Although nursing interventions have demonstrated potential in mitigating these risks, their implementation remains inconsistent. Further research is warranted to assess the long-term effectiveness of targeted, patient-centered self-care education strategies.

Keywords: ICU; Infection Control; Self-care Deficit; Tracheostomy.

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INTRODUCTION

Tracheostomy is a frequently performed procedure among patients in intensive care units (ICUs), particularly those who experience respiratory failure or require extended mechanical ventilation. It supports enhanced airway management and helps to mitigate complications arising from prolonged endotracheal intubation (Kawale, Keche, Gawarle, Bhat, & Buche, 2017). While tracheostomy can contribute to improved recovery outcomes in critically ill patients, it also introduces an elevated risk of infection, especially ventilator-associated infections and hospital-acquired pneumonia (McGrath, Lynch, Wilson, Nicholson, & Wallace, 2016). A significant factor contributing to these infections is the presence of self-care deficits—defined as a patient's inability to independently maintain necessary hygiene and airway care. Consequently, further investigation is warranted to elucidate the link between self-care deficits and infection rates in ICU patients with tracheostomies (Whitmore, Townsend, & Laupland, 2020; Martínez, Connelly, Pérez, & Calero, 2021).

Within critical care settings, tracheostomized patients frequently experience self-care limitations due to underlying conditions such as neuromuscular disorders, cerebral injuries, or systemic illness (Thompson, Cassidy, McKibbin, Sangster, & Foster, 2021). These impairments result in a heightened dependence on healthcare providers for essential care activities, including tracheostomy site maintenance, oral hygiene, and management of airway secretions. Empirical evidence suggests that inconsistencies in care practices can increase the likelihood of bacterial colonization and nosocomial infections, thereby exacerbating patient morbidity and mortality. As a result, a systematic review is necessary to thoroughly investigate how self-care deficits contribute to infection risks in ICU patients with tracheostomies (Yildirim & Tahir, 2017).

Although prior research has addressed specific aspects of tracheostomy care—such as secretion control, oral hygiene, and wound management techniques—these studies have employed varied methodologies, often emphasizing clinical interventions while overlooking the patient's capacity for self-care (Whitmore et al., 2020). Some investigations utilize quantitative analyses to evaluate infection risk factors, whereas others adopt

qualitative frameworks to explore patient experiences and systemic healthcare challenges. This methodological heterogeneity underscores a knowledge gap in fully understanding the direct impact of self-care deficits on infection outcomes among tracheostomized ICU patients (Freeman-Sanderson, Togher, Elkins, & Kenny, 2018).

From a nursing theory perspective, the concept of self-care deficit originates from Dorothea Orem's Self-Care Deficit Nursing Theory (SCDNT), which asserts that individuals who are unable to meet their self-care needs require professional healthcare intervention (Berbiglia & Thy, 2021). Among ICU patients with tracheostomies, self-care deficits not only encompass an inability to manage physical needs such as wound care and secretion clearance, but also include limitations in communication and mobility, which may hinder adherence to hygiene standards and infection prevention protocols (Vincent et al., 2006).

This review will include studies that investigate the relationship between self-care deficits and infection risks in ICU patients with tracheostomies, incorporating both quantitative and qualitative methodologies. The selected literature consists of experimental research, observational analyses, and systematic reviews published in peer-reviewed journals within the past decade. Comprehensive database searches will be conducted using platforms such as PubMed, Scopus, Web of Science, and the Cochrane Library to ensure robust coverage of the subject (Peters, 2020).

A scoping review design is particularly well-suited to address this complex area of inquiry, as it permits the inclusion of a broad range of research approaches and perspectives (Tricco et al., 2018). This methodology will enable the identification of key variables influencing the association between self-care deficits and infection incidence, the synthesis of principal findings from existing literature, and the recognition of areas requiring further research. Ultimately, the results of this review are expected to inform future studies and support the development of targeted interventions aimed at reducing infection rates in ICU patients with tracheostomies (Arksey & O'Malley, 2005; Levac, Colquhoun, & O'Brien, 2010).

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RESEARCH METHOD

This scoping review was carried out in accordance with the most recent methodological recommendations established by the Joanna Briggs Institute (JBI) and guided by the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) framework. The review focused on intensive care unit (ICU) patients with tracheostomies, centering on the concept of self-care deficits and their role in the development of infections. This includes consideration of factors affecting self-care capacity, strategies for infection prevention, and the degree of patient reliance on healthcare professionals. The contextual scope encompassed diverse critical care environments globally, such as hospital ICUs and long-term acute care settings.

Only studies that explicitly examined the relationship between self-care deficits and infection in ICU patients with tracheostomy were considered for inclusion. Eligible studies employed quantitative, qualitative, or mixed methods designs to provide a

comprehensive understanding of self-care challenges and their implications for infection risk in this patient population. The literature search was conducted using academic databases including ProQuest, JSTOR, Google Scholar, and BMC. The search strategy incorporated the following keywords: "Tracheostomy" AND "Infection" AND "ICU" AND "Self-Care Deficit."

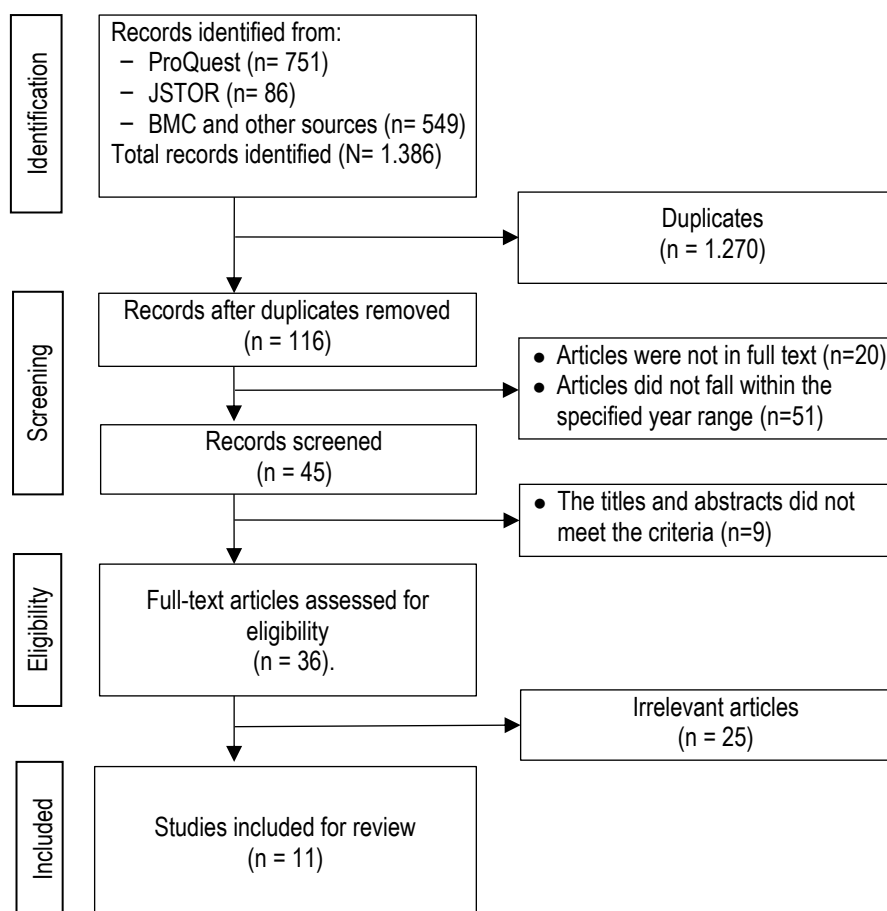
From the initial search, 751 articles were identified through ProQuest, 86 through JSTOR, 6 via BMC, and 543 from other sources, yielding a total of 1,386 records. Following the removal of duplicates and a preliminary screening based on titles and abstracts, 116 articles were selected for full-text review. After a thorough eligibility assessment, 11 studies met the inclusion criteria and were retained for in-depth analysis in this review. Among the 11 articles included in the final analysis, a variety of study designs were identified, including case study (n=1), cohort study (n=5), cross-sectional study (n=2), and quasi-experimental study (n=3).

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RESEARCH RESULTS



Picture 1. PRISMA Flowchart

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Table Main Characteristics of Included Studies

(Author, Year) (Country)	Purpose	Method	Results
(Yustilawati et al., 2024) (Indonesia)	To examine the effectiveness of oral hygiene using honey in patients with multiple fractures and self-care deficit issues in preventing Ventilator Associated Pneumonia (VAP) in the ICU of Wahidin Sudirohusodo Makassar Hospital.	A case study employing observation sheets and documentation.	After the intervention was given for 3 consecutive days, the patient experienced oral health improvement, assessed by the BOAS score and MPS score. For the BOAS score, there was a significant change from moderate dysfunction (BOAS score 15) to mild dysfunction (BOAS score 8). For the MPS score, there was a significant change from poor (MPS score 7) to good (MPS score 4).
(Jansson et al., 2019) (Finland)	To determine whether nurse staffing and nursing workload are associated with ventilator-associated pneumonia and mortality.	This prospective, observational cohort study was conducted in a single tertiary-level teaching hospital in Finland during 2014–2015. The association between nurse staffing, nursing workload and prognosis was determined by using daily nurse-to-patient ratios, Therapeutic Intervention Scoring System and Intensive Care Nursing Scoring System scores, and Intensive Care Nursing Scoring System indices. Ventilator-associated pneumonia was defined according to the Centers for Disease Control and Prevention criteria.	Evaluable data was available for 85 patients. The overall ventilator-associated pneumonia and 28-day mortality rates were 23.5% and 35.3%, respectively. Nurse staffing, measured as the daily lowest nurse-to-patient ratio ($p= 0.006$) and median Intensive Care Nursing Scoring System index ($p= 0.046$), were significantly lower in patients with ventilator-associated pneumonia. In addition, nursing workload, measured as median scores obtained by the Therapeutic Intervention Scoring System ($p= 0.009$) and Intensive Care Nursing Scoring System ($p= 0.03$), was significantly higher in infected patients. The median ($p= 0.02$) and daily highest ($p= 0.03$) Intensive Care Nursing Scoring System scores were significantly higher in non-survivor

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(Author, Year) (Country)	Purpose	Method	Results
(Wei et al ., 2022) (China)	To assess the practicing situation of nurses in the intensive care unit (ICU) for postoperative patients with oral cancer and their need for training.	A multicenter cross-sectional study design was conducted in 19 ICUs of 11 tertiary hospitals from Henan province in China. Data were collected from 173 nurses and 19 head nurses online using a structured questionnaire. Mann–Whitney U and Kruskal–Wallis H tests were performed to analyze the data using SPSS (Version 25.0).	In this study, 36.8% of ICUs had established evaluation protocols for oral care in postoperative oral cancer patients, while 42.1% had documented operational standards. Among 173 surveyed nurses, the median questionnaire score was 75 (IQR: 68–78). A majority (91.2%) conducted oral hygiene assessments at fixed times, though 52.0% and 28.3% individualized the timing and frequency of oral care, respectively. Over half (55.5%) spent 5–10 minutes per oral care session. Commonly used resources included physiological saline (82.7%), swabbing (91.9%), and cotton ball-based oral care kits (86.1%). Nurses primarily consulted senior nurses (87.3%) and physicians (83.8%) for oral care challenges. The main reported barrier was insufficient knowledge and skills (76.9%). Most nurses (69.4%) had not received continuing education in this area, though nearly all (98.8%) expressed interest in standardized oral care training. Key topics of interest included indications and contraindications (84.4%), tools (81.5%), and mouthwash selection (80.9%), with scenario-based simulation being the preferred training method for the majority.

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(Author, Year) (Country)	Purpose	Method	Results
(Wang, 2021) (France)	To develop and validate a pictographic educational handout on tracheostomy care for patients with head and neck cancer and their family caregivers.	This participatory action research involved multidisciplinary experts (n=13), patients (n=22), and caregivers (n=17) in Cleveland, Ohio. Graphic designers and clinical researchers developed a pictographic educational handout, which was iteratively evaluated and revised three times using expert feedback and a handout evaluation tool.	The final version demonstrated content validity and usability with high content validity index of 88.3% in clinical and 89.1% in user experts. The pictographic intervention also showed a medium to large effect size on improving patients and caregivers' self-efficacy on tracheostomy care. Furthermore, a regression model with cognition preferences, anxiety, age and comorbidities explained 57.3% of variance in self-efficacy.
(Anggraeni et al., 2020) (Indonesia)	To analyze the effect of oral care intervention on oral health status of intubated patients in the ICU.	A pre-experimental study with one group pre-test post-test design. A consecutive sampling was used to select 18 intubated patients in the ICU of Al Islam hospital in Bandung. Oral health status was evaluated by Beck Oral Assessment Scale (BOAS). Descriptive analysis was used for the univariate analysis and t-test was used for bivariate analysis.	Oral health scores before and after intervention were 11.94 and 13.28 (p=. 004). The BOAS subscales had a significant worsening of the lips, gingiva, oral mucosa and saliva (p<. 05), while there was an improvement in teeth subscale after oral care intervention (p<. 001).

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(Author, Year) (Country)	Purpose	Method	Results
(Lee et al., 2022) (Canada)	To determine the in-hospital survival of elderly ICU patients following tracheostomy, and describe impacts on discharge disposition and functional outcomes.	A historical cohort study at two academic hospitals in Toronto. All patients aged ≥ 70 yr who received a tracheostomy during their ICU stay between January 2010 and June 2016 were included in a retrospective chart review. Data on patient demographics, frailty, tracheostomy indication, and outcomes were collected.	The study involved 270 patients (mean age 81 ± 6 years), primarily admitted for respiratory failure (54%) and undergoing tracheostomy for prolonged ventilation (75%). ICU and hospital mortality rates were 26% and 46%, respectively. Only 25% were decannulated during hospitalization (median 41 [IQR 25–68] days post-tracheostomy). Median ICU and hospital stays were 31 [17–53] and 81 [46–121] days. At discharge, 6% returned home, all were frail, and most were tube-fed (70%), nonverbal (56%), and nonambulatory (68%).
(Madden et al., 2021) (Ireland)	To examine HH among healthcare workers (HCWs) in ICU settings, and identify whether there is a statistical difference in HH compliance between patient-protective and self-protective moments, while controlling for other variables known to influence HH compliance (i.e. professional role, unit and shift time).	A cross-sectional observational study was conducted in four ICUs across three Irish hospitals. Compliance was assessed according to the WHO's 'five moments for hand hygiene'. HCW professional role, total number of 'opportunities' for HH and whether compliance was achieved were recorded.	A total of 712 HH opportunities were recorded, with an overall compliance rate of 56.9%. Logistic regression analysis revealed that physicians, allied healthcare professionals and auxiliary staff were less likely than nurses to engage in HH. HCWs were more likely to comply during night shifts compared to morning shifts, and with self-protective as compared to patient-protective HH moments.

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(Author, Year) (Country)	Purpose	Method	Results
(Puetpaiboon et al., 2022) (Thailand)	To describe weaning outcomes of such patients in the general wards, and the secondary objective was to assess predictors associated with prolonged weaning in these patients.	A retrospective study conducted in a tertiary care hospital in Thailand. From January 2014 to December 2019, we identified 553 patients who received postoperative mechanical ventilation in general wards after non-cardiac surgeries. The weaning characteristics and the factors associated with prolonged ventilation and weaning were recorded.	Weaning outcomes were classified as short (≤ 24 h, 53.0%), difficult ($>1-7$ days, 28.6%), prolonged (>7 days, 15.0%), and no weaning (3.4%). Prolonged weaning was associated with postoperative GCS ≤ 8 (OR 11.34), repeated surgeries (OR 7.38), total functional dependency (OR 3.22), and age >65 years (OR 2.35). Reintubation and accidental extubation rates were 5.1% and 2.3%, respectively. Ventilator-associated pneumonia occurred in 11.6% of patients, and 30-day mortality was 6%.
(Simonis, 2019) (Netherlands)	To identify potentially modifiable factors associated with outcome of these patients.	The PROVENT was an international, multi-center, prospective cohort study of consecutive patients under invasive mechanical ventilatory support. A pre-defined secondary analysis was to examine factors associated with mortality. The primary endpoint was all-cause in-hospital mortality.	Among 935 patients, in-hospital mortality was 21%. Survivors had lower ARDS risk scores, received lower Pmax, driving pressure, PEEP, and FiO ₂ levels, while tidal volumes were similar. Higher Pmax was independently linked to mortality, whereas ΔP was not, though data were limited. Non-modifiable mortality predictors included older age, immunosuppression, higher non-pulmonary SOFA scores, lower oxygen saturation, elevated heart rates, and functional dependence.

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(Author, Year) (Country)	Purpose	Method	Results
(Agarwal et al., 2017) (India)	To identify the gap between what is known and what is done for oral care in Intensive care units.	A cross-sectional survey of paramedical and medical staff working conducted in various ICU's in government and private setups in Lucknow. The population of interest was critical care nurses and paramedical staff providing care for adult patients receiving mechanical ventilation in Lucknow city in an acute care setting.	78% of respondents had knowledge regarding oral care and its importance in critical settings but 44% of respondents considered it to be unpleasant task. 36% of respondents claimed to have provided oral care to all patients in ICU. Uniform guidelines for translation of oral healthcare in ICU settings are not being implemented. Previous studies in literature from various geographic diverse regions also point out to similar lacunae. Based on present survey, most respondents were aware of importance of oral care with protocols covered in academic curriculum. Attitude towards oral care is positive but respondents feel a need for specialised training. Practice for oral care is not sufficient and needs improvement and proper implementation.
(Fernando et al., 2019) (Canada)	To evaluate the association between frailty, defined by the Clinical Frailty Scale (CFS), and outcomes of ICU patients receiving invasive mechanical ventilation.	A retrospective analysis (2011–2016) of a prospectively collected registry was conducted in two hospitals of consecutive ICU patients ≥ 18 years of age receiving invasive mechanical ventilation. CFS scores were based on recorded pre-admission function at the time of hospital admission.	Among 8,110 patients, 31.2% were identified as frail (CFS ≥ 5). Frailty was significantly associated with higher odds of hospital mortality (aOR 1.24), discharge to long-term care (aOR 1.21), extubation failure (aOR 1.17), death after extubation failure (aOR 1.18), tracheostomy (aOR 1.17), and death following tracheostomy (aOR 1.14).

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DISCUSSION

Existing research on self-care deficits and their influence on infection rates among ICU patients with tracheostomies suggests that impaired self-care capacity markedly elevates the risk of hospital-acquired infections, particularly ventilator-associated pneumonia (VAP) and lower respiratory tract infections. This scoping review integrates key findings related to the effects of self-care limitations, the practical challenges associated with tracheostomy care, and the existing gaps in the literature regarding infection outcomes in this patient population.

The Relationship Between Self-Care Deficit and Infection Risk in ICU Patients with Tracheostomy

The inability of ICU patients to independently manage tracheostomy care is a primary factor in the increased risk of infections. Patients with neurological disorders, altered consciousness, or muscle weakness often lack the ability to control secretions, maintain wound hygiene, and ensure airway cleanliness, ultimately leading to bacterial colonization and infection (McGrath et al., 2016).

A study found that patients experiencing severe self-care deficits had a higher infection risk compared to those with some degree of independence (Freeman-Sanderson et al., 2018). Similarly, reported that poor oral and airway hygiene significantly contributed to increased lower respiratory tract infections in ICU patients with tracheostomy (Whitmore et al., 2020).

Impact of Self-Care Deficit on Patient Morbidity and Quality of Life

ICU patients with tracheostomies are dependent on healthcare providers for secretion management and wound care not only increases the risk of infection but also affects the recovery process and overall quality of life. Previous studies have shown that patients with greater self-care deficits experience longer hospital stays, higher rates of complications, and lower quality of life compared to those who are able to participate in their own care (Yildirim et al., 2017). In addition, another study found that ICU patients who received pre-discharge education about tracheostomy care had a lower risk of infection compared to those who did not receive

such education. These findings underscore the importance of patient-centered interventions in infection prevention (Vincent et al., 2006).

Challenges in Tracheostomy Care Implementation

Despite the existence of clinical guidelines for tracheostomy care, several challenges persist in ICU settings, including: variability in tracheostomy care practices, many hospitals lack standardized protocols for tracheostomy wound cleaning, suctioning techniques, and oral hygiene maintenance. A study found that inconsistencies in care increased the risk of infection (Freeman-Sanderson et al., 2018); limited resources and high workload in ICU settings, identified that low nurse-to-patient ratios and high workloads reduced the effectiveness of nursing interventions in preventing infections, particularly in monitoring and maintaining airway hygiene in tracheostomy patients (Thompson et al., 2021); lack of patient and caregiver education, tracheostomy care for patients after ICU discharge remains insufficient, a study found that patients who received comprehensive education before discharge had lower infection rates, emphasizing the need for more structured and detailed education strategies (Vincent et al., 2006).

Research Gaps and Future Directions

Although numerous studies have highlighted the link between airway hygiene and infection risk in ICU patients with tracheostomy, certain gaps remain in the literature that require further investigation including limited longitudinal studies, most existing studies have only evaluated the short-term effects of self-care deficits on infection risk one study stated that longitudinal studies assessing how infection rates develop after ICU discharge are lacking (Vincent et al., 2006) and lack of patient-centered interventions, where current research primarily focuses on the role of healthcare providers in infection prevention, but few studies have explored patient and caregiver education strategies to improve self-care skills in tracheostomy management.

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The Relationship Between Self-Care Deficit and Infection Risk in ICU Patients with Tracheostomy

Self-care deficit refers to a condition in which patients are unable to perform adequate self-care, including maintaining airway and tracheostomy wound hygiene. ICU patients with tracheostomy often experience limitations in secretion control, tracheostomy site care, and oral hygiene maintenance, all of which significantly increase the risk of nosocomial infections, particularly ventilator-associated pneumonia (VAP) and lower respiratory tract infections (McGrath et al., 2016).

A study found that patients with severe self-care deficit had a twofold increased risk of infection compared to those with partial self-care ability (Freeman-Sanderson et al., 2018). These findings support reports that poor oral and respiratory hygiene leads to bacterial colonization, which is a major factor contributing to decreased respiratory tract infections in ICU patients with tracheostomy (Whitmore et al., 2020).

The main mechanisms linking self-care deficits to infection risk in ICU patients with tracheostomies include: Accumulation of secretions where patients who are unable to manage secretions independently experience mucus retention, which provides an ideal environment for bacterial growth (Thompson et al., 2021). Poor oral hygiene where the inability to maintain oral hygiene independently increases the risk of bacterial colonization from the oral cavity to the respiratory tract (Whitmore et al., 2020). Inadequate tracheostomy wound care where patients with self-care deficits are unable to change wound dressings regularly, leading to local infections that can progress to sepsis (McGrath et al., 2016).

The Role of Healthcare Providers in Preventing Infection Due to Self-Care Deficit

Given the high level of dependence ICU patients with tracheostomies have on healthcare providers for routine care, nursing interventions are essential in minimizing infection risk. Evidence suggests that adherence to comprehensive tracheostomy care protocols—including consistent wound cleaning, scheduled suctioning, and rigorous oral hygiene—can significantly reduce infection rates (Yıldırım et al., 2017). However, additional studies have identified factors such as excessive workload and

insufficient nurse-to-patient ratios as key barriers to delivering optimal care. ICUs facing staffing shortages are particularly vulnerable to increased infection rates due to time constraints that impede effective airway hygiene practices (Thompson et al., 2021).

Several nursing strategies have demonstrated efficacy in reducing infection risk. These include the implementation of standardized wound care protocols, where the regular application of antiseptic agents and prompt dressing changes help prevent local infections (McGrath et al., 2016). Additionally, the use of sterile suctioning techniques in accordance with established guidelines can minimize the risk of respiratory infections associated with contaminated equipment (Yıldırım et al., 2017). Enhanced training and continuous education of nursing staff further contribute to the delivery of safe and effective tracheostomy care.

Challenges in Implementing Tracheostomy Care in ICU Settings

Despite the existence of clinical guidelines for tracheostomy care, several barriers hinder their consistent application within ICU settings. One major challenge is the lack of uniform standards across institutions; not all healthcare facilities have established protocols for managing tracheostomy patients. Research indicates that such variability in care practices contributes to inconsistencies in nursing interventions and a heightened risk of infection (Freeman-Sanderson et al., 2018). Additionally, limited ICU resources and infrastructure have been identified as significant obstacles. Facilities lacking adequate medical supplies—such as sterile suction equipment, antiseptic agents, and appropriate wound care materials—report higher incidences of infection (Whitmore et al., 2020). Furthermore, high patient-to-nurse ratios and understaffing often compromise the quality of tracheostomy care. The resulting increased workload can lead to caregiver fatigue and burnout, adversely affecting patient outcomes and elevating infection risk (Thompson et al., 2021).

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CONCLUSION

Self-care deficits in ICU patients with tracheostomy increase the risk of infections, particularly VAP and lower respiratory tract infections, due to the inability to manage hygiene and secretions. Other contributing factors include limited resources, lack of standardized care protocols, and insufficient education. While nursing interventions have proven effective, their implementation remains inconsistent, and research gaps still exist regarding the long-term impact and effectiveness of patient-centered self-care education.

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