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Research Article

Quality of Nursing Care of Patients under Mechanical Ventilation in Intensive Care Unit in Taif City, Saudi Arabia in 2024

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Abstract

Background: *Nurses have an important role in intensive care units (ICUs), significantly impacting patient outcomes through the quality of care provided. Enhanced education and training are essential for improving nursing care for mechanically ventilated (MV) patients. Mechanical ventilation, crucial for supporting critically ill patients, requires skilled nursing management to ensure positive outcomes. The aim of this study was to assess the quality of nursing care provided to patients under mechanical ventilation in the ICU in Taif City, focusing on nurses' knowledge, performance, and the impact of demographic factors.*

Methods: *This cross-sectional, hospital-based descriptive study was conducted at King Abdulaziz Specialist Hospital and King Faisal Specialist Hospital & Research Centre in Taif Governorate. The study included ICU nurses with at least one year of experience, selected through convenience sampling. Data collection involved a questionnaire assessing knowledge of MV care and an observational checklist evaluating nursing practices. Data were analyzed using SPSS version 23.*

Results: *Among the 102 ICU nurses. The majority (75.5%) were aged 25-35 years, with a mean age of 26.22±2.85 years, 51.0% were female, and 69.6% were non-Saudi. Educational qualifications showed 64.7% held bachelor's degrees, and 64.7% had 1-5 years of experience. Knowledge assessment revealed 51.0% had poor knowledge, 38.2% had average knowledge, and 10.8% had good knowledge (mean score: 23.86±4.73). Practice assessments showed significant variability, with poor practice levels notably high in chest physiotherapy (66.7%) and overall care (68.6%). Significant correlations were found between educational qualifications ($p = 0.007$) and years of experience ($p = 0.028$) with knowledge levels.*

Conclusion: *Nurses' knowledge and practice regarding mechanical ventilators in selected public hospitals were suboptimal. Enhancing educational qualifications and providing targeted training programs are crucial for improving nursing care for MV patients. Implementing evidence-based practices and fostering effective communication within healthcare teams can improve patient outcomes.*

The presence of Certified Nurse Specialists (CNS) as ICU head nurses has been linked to better patient outcomes and fewer ventilator-dependent patients, highlighting the importance of specialized nursing leadership.

Keywords: *Mechanical ventilation, ICU nursing care, nurse education, patient outcomes, evidence-based practice, Certified Nurse Specialist, critical care, ventilator management, healthcare training, patient safety, nursing interventions, Taif City.*

Introduction

Nurses played a crucial role among healthcare workers, particularly in the intensive care unit (ICU), where the quality of nursing care significantly impacted patient outcomes. Improved education and training for nurses enhanced the quality of care provided to ICU patients. Danielis et al. (2020) highlighted that a well-designed nursing care plan was essential for ICU patients, showing the promotion of education levels among nurses. The ICU, a specialized care area, aimed to provide critical care to improve patients' clinical conditions. The need for intensive care increased, making mechanical ventilation (MV) a vital supportive therapy for patients with compromised respiratory function (Mohammed & Ebrahem, 2022).

Mechanical ventilation was widely used in ICUs to support critically ill patients, with survival rates varying due to differences in patient selection, care standards, and population characteristics (Taha et al., 2019). The indications for MV ranged from postoperative management and drug intoxication to acute respiratory failure caused by various conditions such as COPD and multiple traumas (Hesham, 2016). Nurses were often the first to manage critically ill patients and were responsible for recognizing and addressing issues related to MV settings. Andres and Jorge (2022) showed that nurses' expertise in ventilator management, patient care, and the identification of potential complications was vital for improving patient outcomes.

Quality nursing care in the ICU involved not only the technical management of ventilators but also the holistic care of the patient. Jackson and Cairns (2021) noted that critical care nurses played a key role in enhancing the effectiveness of MV, preventing harm, and optimizing outcomes. Ensuring high-quality care and patient satisfaction was a technical and social imperative in healthcare (Duffy, 2022). Therefore, nurses needed to be knowledgeable about ventilator functions, potential complications, and appropriate patient management (Emel & Ekici, 2020).

The research problem focused on the increasing demand for mechanical ventilation in ICUs, driven by an aging population, advancements in therapy, and increased ICU bed capacity. Effective nursing care was central to managing the complexities of MV and ensuring positive patient outcomes. Despite the critical role of nurses, studies showed that knowledge about MV among ICU nurses globally was often inadequate (HadiAtiyah & Abdul-Wahhab, 2016). Furthermore, recent studies in Saudi Arabia highlighted the need for improved training and education for ICU nurses regarding MV (Aldhahir et al., 2024).

Pulmonary ventilation, the process of air moving in and out of the lungs, was critical for gas exchange and was influenced by mechanical ventilation. Mechanical ventilation altered normal respiratory physiology, impacting lung mechanics and cardiac output (Tobin, 8). Proper management of MV involved understanding key parameters such as tidal volume, airway pressure, and compliance, which were essential for optimizing patient care and preventing complications (Christou et al., 2020). The various modes of ventilation, including assist control, synchronized intermittent mandatory ventilation, and pressure support, each had specific applications and implications for patient management (Carpio & Mora, 2023).

Mechanical ventilation, while life-saving, carried risks such as ventilator-associated lung injury and other complications. Preventing these complications required vigilant nursing care, including proper hand hygiene, monitoring, and management of ventilator settings (Ramirez-Estrada et al., 2023). Additionally, the discontinuation of mechanical ventilation involved systematic steps and assessment to ensure patient safety and successful weaning (Burns et al., 2021).

Nursing care for mechanically ventilated patients included preparation, equipment management, and patient monitoring. Ensuring compliance with protocols and maintaining detailed documentation were crucial for patient safety and quality care (Williams & Sharma, 2023). Family involvement and education were also important aspects of care, helping to alleviate anxiety and improve patient outcomes (Salmani et al., 2022). Continuous education and competency assessments for nurses were necessary to maintain high standards of care and address the complexities of mechanical ventilation (Hassen et al., 2023).

Research by Powers and Dhamoon (2021) on the pulmonary ventilation process showed the importance of the flow of air into and out of the alveoli for effective gas exchange. Changes in the ventilation/perfusion (V/Q) ratio could affect gas exchange and contribute to hypoxemia. Davies and Misra (2014) highlighted that the process of inhalation and exhalation involved complex interactions between muscles and pressure gradients, which were significantly altered by mechanical ventilation.

In terms of mechanical ventilation physiology, Tobin (2018) described how positive pressure ventilation

changed normal respiratory mechanics, potentially decreasing venous return and cardiac output. Poor (2018) further discussed how mechanical ventilation reduced the work of breathing, redistributed blood flow, and helped improve acidosis in patients with respiratory failure.

Clinical management of mechanical ventilation required an understanding of lung compliance and pressures, as described by Christou et al. (2020). Pham et al. (2017) stressed the importance of avoiding barotrauma and maintaining appropriate ventilation settings to manage hypercapnia or acidosis. The use of mechanical ventilation extended beyond the ICU, with applications in managing conditions such as ARDS and COPD. Brochard and Lellouche (2013) explained the use of pressure support ventilation (PSV) for ventilator weaning, while Zhou et al. (2017) discussed the benefits of airway pressure release ventilation (APRV) for patients with difficult-to-oxygenate lungs.

Ventilator-associated events (VAE) and ventilator-induced lung injury (VILI) were significant concerns, as highlighted by Hyzy and Slutsky (2020). Strategies to prevent these complications included lung protective strategies, minimizing sedation, and daily spontaneous breathing trials (Ramirez-Estrada et al., 2023). The process of mechanical ventilation discontinuation involved systematic steps to ensure patient safety, as described by Burns et al. (2021).

Overall, the quality of nursing care for mechanically ventilated patients depended on a comprehensive understanding of mechanical ventilation, vigilant monitoring, and adherence to evidence-based protocols. This study aimed to assess the quality of nursing care provided to patients under mechanical ventilation in the ICU in Taif City in 2024, focusing on nurses knowledge, performance, and the impact of demographic factors.

Methods

The study was conducted at King Abdulaziz Specialist Hospital and King Faisal Specialist Hospital & Research Centre in Taif Governorate. King Abdulaziz Specialist Hospital, with its multiple specialties and a bed capacity of 500, aimed to provide high-quality healthcare and educational services. King Faisal Specialist Hospital & Research Centre, with an 800-bed capacity including 300 for maternity and children, aimed to deliver top-tier healthcare within an integrated educational and research setting.

A cross-sectional, hospital-based descriptive study using a quantitative approach was employed. The target population consisted of staff nurses with at least one year of ICU experience, responsible for bedside patient care at the selected hospitals. Nurses available during data collection and willing to participate were included

in the study.

Stratified sampling was used, after sample size calculation using the suitable equation based on the total population size (117 ICU nurses in all hospitals of the study area. Then, selecting nurses proportionally to the number of staff in each hospital until the required sample size was met. Data collection involved a questionnaire and an observational checklist. The questionnaire, developed after reviewing relevant literature, assessed nurses' knowledge about nursing care for mechanically ventilated patients, including personal characteristics and 20 knowledge questions. The observational checklist, based on a pediatric nursing procedures manual (Hockenberry, 2023), assessed the quality of nursing care practices.

Knowledge scoring included 20 questions with a total score of 40, categorized as good (75-100%), average (60-74%), and poor (<60%). Practice scoring evaluated procedures as completely done (2), partially done (1), or not done (0). Validity was confirmed by five critical care nursing experts, and reliability was assessed using Cronbach's alpha (0.87). A pilot study with 10% of subjects ensured clarity and tool applicability. Official permission was obtained, and the questionnaire was distributed to nurses at the selected hospitals. Data collection occurred according to a time plan, with interviews and observations conducted during morning shifts. Ethical considerations included Ethics Committee approval, participant consent, anonymity, confidentiality, and conflict of interest avoidance.

Data were analyzed using SPSS version 23. Limitations included sample size, selection bias, measurement bias, time constraints, and resource limitations, potentially impacting the study's generalizability, validity, and reliability.

Results

The study included 102 nurses from King Abdulaziz Specialist Hospital and King Faisal Specialist Hospital & Research Centre. The majority (75.5%) were aged 25-35 years, with a mean age of 26.22±2.85 years. The gender distribution was almost equal, with 51.0% female and 49.0% male. Most participants were married (71.6%) and non-Saudi (69.6%). Regarding educational qualifications, 64.7% held bachelor's degrees, and 53.9% resided in rural areas. The majority (64.7%) had 1-5 years of experience in ICU. Also, 37.3% of them had previous training program in the care of patients under mechanical ventilation in the intensive care unit among the studied nurses as detailed in table 1.

Table (1): Percentage distribution of the studied nurses according to their socio-demographic characteristics (n=102)

Socio-demographic characteristics		N	%
Age	25-35 years	77	75.5
	36-45 years	25	24.5
	Mean ± SD	26.22±2.85	
Gender	Male	50	49.0
	Female	52	51.0
Marital Status	Single	22	21.6
	Married	73	71.6
	Divorced	3	2.9
	Widowed	4	3.9
Nationality	Non-Saudi	71	69.6
	Saudi	31	30.4
Educational qualifications	Diploma	28	27.5
	Bachelor	66	64.7
	Master	5	4.9
	Doctoral	3	2.9
Residence	Urban	47	46.1
	Rural	55	53.9
Years of experience	1-5 years	66	64.7
	6-10 years	23	22.5
	11 – 15 years	13	12.7

In terms of knowledge, nearly half of the nurses demonstrated a complete understanding of key concepts related to mechanical ventilation, such as indicators of weaning (50.0%), prevention of ventilator-associated pneumonia (49.0%), and how to prevent nosocomial infections (47.1%). However, there were areas with lower comprehension, such as the definition of weaning from mechanical ventilation (8.8%) and sufficient respiratory muscle strength as an indicator for weaning (8.8%). The knowledge assessment, based on 20 questions, revealed that over half of the nurses (51.0%) had poor knowledge, 38.2% had average knowledge, and only 10.8% demonstrated good knowledge. The mean knowledge score was 23.86 with a standard deviation of 4.73, indicating a wide range of knowledge levels among the nurses as reported in table 2.

Regarding practice, many nurses performed critical procedures incompletely. For hand hygiene, steps such as rubbing hands together vigorously for at least 20 seconds and drying hands with a clean towel were incompletely done by 52.0% and 49.0% of nurses, respectively. When measuring axillary temperature, ensuring the patient was in a comfortable position was incompletely done by 56.9%, and cleaning the thermometer probe with an alcohol swab was incompletely done by 51.0%. For endotracheal tube suctioning, while all nurses connected the suction catheter to the suction source correctly, 85.3% incompletely applied intermittent suction while rotating and withdrawing the catheter. In chest physiotherapy, 57.8% incompletely performed percussion, and 52.9% incompletely followed with vibration. Intravenous infusion practices showed that verifying prescribed medication or solution and the rate of infusion was incompletely done by 82.4% of nurses. Mouth care practices revealed that 73.5% of nurses incompletely moistened the toothbrush or swab. Eye care practices showed 73.5% incompletely used a clean, soft cloth or sterile saline-soaked gauze. In positioning, 83.3% incompletely placed patients in a side-lying position. (See annex 1 for the details findings).

The general practice assessments encompassed various critical care procedures, each with a different number of assessment questions. The results highlighted significant variability in practice quality. For hand hygiene, which consisted of six questions, over half of the nurses (55.9%) had poor practice, 29.4% had average practice, and 14.7% had good practice, with a mean score of 6.05±2.25. Measuring axillary temperature, also with six questions, showed that 28.4% of nurses had poor practice, 37.3% had average practice, and 34.3% had good practice, with a mean score of 8.11±2.31.

For endotracheal tube suctioning, which involved ten questions, the majority (54.9%) had poor practice, 32.4% had average practice, and 12.7% had good practice, with a mean score of 11.12±2.78. Chest physiotherapy, with six questions, revealed that 66.7% had poor practice, 31.4% had average practice, and only 2.0% had good practice, with a mean score of 5.34±2.19. Intravenous infusion, assessed with nine questions, showed that 43.1% had poor practice, 37.3% had average practice, and 19.6% had good practice, with a mean score of 10.52±2.66 as reported in table 2.

Mouth care, assessed with eight questions, revealed that 56.9% of nurses had poor practice, 30.4% had average practice, and 12.7% had good practice, with a mean score of 8.21±2.53. Eye care, with six questions, showed that 46.1% had poor practice, 36.3% had average practice, and 17.6% had good practice, with a mean score of 6.85±2.17. Positioning, assessed with nine questions, indicated that 58.8% had poor practice, 38.2% had average practice, and only 2.0% had good practice, with a mean score of 10.48±2.58. Overall

care of patients under mechanical ventilation showed that 68.6% of nurses had poor practice, 27.5% had average practice, and only 3.9% had good practice as reported in table 2.

Table (2) the overall knowledge and practice assessment findings toward quality of nursing care of patients under mechanical ventilation in intensive care unit (n = 102)

Category (Number of assessment questions)		Overall assessment level			Mean score ± SD (Range)
		Poor	Average	Good	
Knowledge	**On mechanical ventilation (20)**	52 (51.0%)	39 (38.2%)	11 (10.8%)	23.86±4.73 (1-37)
Practice	**Hand hygiene (6)**	57 (55.9%)	30 (29.4%)	15 (14.7%)	6.05± 2.25 (2-10)
	Measuring Axillary Temperature (6)	29 (28.4%)	38 (37.3%)	35 (34.3%)	8.11±2.31 (4-12)
	Endotracheal Tube Suctioning (10)	56 (54.9%)	33 (32.4%)	13 (12.7%)	11.12±2.78 (5-11)
	Chest Physiotherapy (6)	68 (66.7%)	32 (31.4%)	2 (2.0%)	5.34 ± 2.19 (2-12)
	Intravenous Infusion (9)	44 (43.1%)	38 (37.3%)	20 (19.6%)	10.52 ± 2.66 (5-17)
	Mouth Care (8)	58 (56.9%)	31 (30.4%)	13 (12.7%)	8.21±2.53 (4-14)
	Eye Care (6)	47 (46.1%)	37 (36.3%)	18 (17.6%)	6.85±2.17 (2-12)
	Positioning (9)	60 (58.8%)	39 (38.2%)	2 (2.0%)	10.48 ±2.58 (6-18)
	Care of patients under MV (overall)	70 (68.6%)	28 (27.5%)	4 (3.9%)	-

The relationship between ICU nurses' demographic and professional characteristics and their knowledge levels was also examined. The study found no significant relationship between knowledge level and age, gender, marital status, or residence. However, a significant relationship was found between educational qualifications and knowledge level ($p = 0.007$). Nurses with diplomas tended to have better knowledge than those with bachelor's degrees or higher. Additionally, there was a significant relationship between years of experience and knowledge level ($p = 0.028$). Nurses with 1-5 years of experience had higher knowledge levels compared to those with more experience.

These findings showed that recent graduates or those new to the field may be more current in their knowledge due to recent training and education as reported in table 3.

Table 3: Relationship between ICU nurses demographic / professional characteristics with their knowledge level (n=102)

Variable		Poor	Fair	Good	Chi square (p value)
Age	**25-35**	38 (49.4%)	32 (41.6%)	7 (9.1%)	1.906 (0.386)
	36-45	14 (56.0%)	7 (28.0%)	4 (16.0%)	
Gender	**Male**	30 (60.0%)	15 (30.0%)	5 (10.0%)	3.361 (0.186)
	Female	22 (42.3%)	24 (46.2%)	6 (11.5%)	
Marital Status	**Single**	6 (27.3%)	12 (54.5%)	4 (18.2%)	10.946 (0.090)
	Married	44 (60.3%)	24 (32.9%)	5 (6.8%)	
	Divorced	1 (33.3%)	1 (33.3%)	1 (33.3%)	
	Widowed	1 (25.0%)	2 (50.0%)	1 (25.0%)	
Educational qualifications	**Diploma**	25 (37.9%)	32 (48.5%)	9 (13.6%)	17.546 (0 .007) *
	Bachelor	21 (75.0%)	6 (21.4%)	1 (3.6%)	
	Master	5 (100.0%)	0 (0.0%)	0 (0.0%)	
	Doctoral	1 (33.3%)	1 (33.3%)	1 (33.3%)	
Residence	**Urban**	19 (40.4%)	21 (44.7%)	7 (14.9%)	4.217 (0 .121)
	Rural	33 (60.0%)	18 (32.7%)	4 (7.3%)	
Years of experience	**1-5 years**	27 (40.9%)	32 (48.5%)	7 (10.6%)	10.862 (0.028) *
	6-10 years	18 (78.3%)	3 (13.0%)	2 (8.7%)	
	11 – 15 years	7 (53.8%)	4 (30.8%)	2 (15.4%)	

** p value was significance at < 0.05*

Discussion

Nurses play a crucial role in managing patients on mechanical ventilators, requiring in-depth scientific knowledge and evidence-based practice. This study aimed to assess the knowledge and practice levels of

ICU nurses in caring for mechanically ventilated patients. The findings highlight the importance of quality nursing care for patients under mechanical ventilation in the Intensive Care Unit in Taif City.

The majority of the studied nurses were aged 25-35 years, predominantly female, married, and non-Saudi. Most had bachelor's degrees and 1-5 years of experience. These demographics are similar to the study by Hassen et al. (2023), where most nurses were aged 20-29 years. However, unlike Hassen et al.'s finding that the majority were male, our study had a nearly equal gender distribution. This difference may be due to the varying cultural and institutional settings. Similarly, Hetland, Heusinkvelt, Krabbenhoft, and Grotts (2018) in Iraq found that a majority of ICU nurses were younger males, which contrasts with our predominantly female cohort.

Regarding training programs, most nurses in our study had not attended any training related to mechanical ventilation, aligning with the study by Dumbre (2019), which also reported low training levels among ICU nurses in Egypt. This lack of training could contribute to the gaps in knowledge and practice observed. Conversely, a study by Anesthesia (2020) in India found that ongoing training programs significantly improved nurses' competency in mechanical ventilation practices.

Knowledge levels among nurses were generally poor, with nearly half scoring poorly on mechanical ventilation knowledge. This finding aligns with the study by Hassen et al. (2023) in Ethiopia, where over half of the nurses had poor knowledge. Similarly, a study in southern India by Anesthesia (2020) found that 53.5% of nurses had poor knowledge of mechanical ventilation. However, Alemayehu et al. (2022) reported higher knowledge levels among nurses in Eastern India, indicating potential regional differences in training and education. Additionally, a study conducted by Hashemian et al. (2018) found that ICU nurses in developed countries had significantly better knowledge and understanding of mechanical ventilation, suggesting that higher resource availability and advanced training programs play a critical role in enhancing knowledge levels.

The practice levels were similarly low, with two-thirds of nurses demonstrating poor practice in caring for mechanically ventilated patients. This is consistent with Hassen et al. (2023) and Anesthesia (2020), who also reported poor practice levels among ICU nurses. However, Addisu (2019) found better practice levels among nurses in Sri Lanka, suggesting variations in training programs and healthcare practices. Furthermore, a study by Taha et al. (2019) in Saudi Arabia found that ICU nurses who received specialized training in mechanical ventilation demonstrated significantly better practice levels compared to those who did not receive such training, highlighting the importance of targeted educational interventions.

A study by Jing, Qian, and Yi (2021) indicated that education significantly improves nurses' competence in managing mechanical ventilation. They found that education interventions increased nurses' knowledge about ventilator-associated complications and improved their competence in using ventilators. This showed the need for continuous education and training programs to enhance nurses' skills and knowledge. Similarly, Sjoding, Gong, Haas, and Iwashyna (2019) in Australia found that structured education programs significantly increased nurses' confidence and autonomy in using lung protective strategies, further supporting the benefits of continuous professional development.

The importance of holistic care was showed by Rak et al. (2020), who noted that critical care staff, particularly nurses, play a central role in providing comfort and security to patients. Integrating psychological and social aspects into care planning is essential for holistic patient care, which includes not only technical skills but also the manner in which care is provided. Andres and Jorge (2022) also highlighted that holistic nursing care, which encompasses emotional and psychological support, is crucial in improving patient outcomes and satisfaction in the ICU.

The role of head nurses and Certified Nurse Specialists (CNS) in managing ward policy, staff, and finances to achieve ward goals is crucial. The presence of a CNS as head nurse was associated with reduced mortality and fewer patients requiring ventilators, highlighting the impact of specialized nursing leadership on patient outcomes. Mohammed and Ebrahem (2022) also found that effective nursing leadership, characterized by strong communication and organizational skills, was instrumental in improving the quality of care in ICUs and reducing patient mortality rates.

In conclusion, the study found significant gaps in the knowledge and practice levels of ICU nurses regarding mechanical ventilation. Continuous education and training programs are essential to improve these aspects. Additionally, incorporating holistic care practices and effective nursing leadership can enhance patient outcomes in ICU settings. This study showed the critical need for targeted educational interventions and the implementation of best practice guidelines to ensure high-quality nursing care for mechanically ventilated patients.

Conclusion

The study showed that knowledge and practice regarding mechanical ventilators among nurses in selected public hospitals were suboptimal. Educational level was significantly associated with both knowledge and practice, indicating that enhancing the educational qualifications of ICU nurses is crucial. Improving

education can enhance nursing interventions, promote patient recovery, maintain oropharyngeal hygiene, adjust pH and blood gas levels, and reduce the risk of ventilator-associated pneumonia (VAP) and other complications, ultimately lowering morbidity and mortality rates.

To improve nursing care for mechanically ventilated patients, targeted educational programs addressing specific knowledge gaps, such as ventilator management and infection control, are essential. Implementing evidence-based practices, such as regular patient repositioning, can prevent complications like pressure ulcers and VAP. Enhancing communication and collaboration within the healthcare team through standardized protocols can improve patient outcomes. Continuous quality improvement initiatives, regular monitoring, and feedback incorporation are vital. Additionally, having a Certified Nurse Specialist (CNS) as the ICU head nurse, combining advanced clinical and management skills, has been associated with better patient outcomes and fewer ventilator-dependent patients. Future research should further explore the clinical value of CNS-qualified head nurses and establish standardized non-invasive mechanical ventilation (NIMV) care protocols.

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Author Contribution

This paper is extracted from the original MSc research conducted by Tagreed Musaad as part of the Master of Nursing in Critical Care program at the University of Hafer Al Batin, College of Applied Medical Sciences. Tagreed Musaad was responsible for the study conception and design, data collection, and initial manuscript drafting. Dr. Salwa Yousif, who served as the supervisor for this research, handled data analysis, interpretation of results, and manuscript revisions. Both authors read and approved the final manuscript.

Conflict of Interest

The authors declare no conflict of interest regarding the publication of this paper. This study was self-funded by the principal authors. All procedures followed were in accordance with ethical standards.

Ethical Consideration

This study was conducted following the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee. Written informed consent was secured from all participants, ensuring anonymity, confidentiality, and the right to withdraw from the study at any time without any consequences.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. All data have been anonymized to protect the privacy of the participants.

References

- Aldhahir, A. M., Alqarni, A. A., Madkhali, M. A., Madkhali, H. H., Bakri, A. A., Shawany, M. A., ... & Hakamy, A. (2024). Awareness and practice of airway pressure release ventilation mode in acute respiratory distress syndrome patients among nurses in Saudi Arabia. BMC nursing, 23(1), 79.
- Alotaibi, A. K., Alotaibi, S. K., Alshayiqi, M., & Ramalingam, S. (2016). Knowledge and attitudes of Saudi intensive care unit nurses regarding oral care delivery to mechanically ventilated patients with the effect of healthcare quality accreditation. Saudi journal of anaesthesia, 10(2), 208–212. https://doi.org/10.4103/1658-354X.177417
- Andres, L.M.C. and Jorge, I.M. (2022): Ventilator Management. [Updated 2022 Mar 27]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK4481 86/
- Danielis, M., Povoli, A., Mattiussi, E., & Palese, A. (2020). Understanding patients' experiences of being mechanically ventilated in the Intensive Care Unit: Findings from a meta-synthesis and meta-summary. Journal of Clinical Nursing, 29(13-14), 2107-2124.
- Duffy, J. R. (2022). Quality caring in nursing and health systems: Implications for clinicians, educators, and leaders. Springer Publishing Company.
- Emel, G. Ü. R., & Ekici, D. (2020). Determining factors that influence nurses' perceptions of quality implementations conducted in hospitals in Turkey. Journal of Nursing Research, 28(3), e91.
- HadiAtiyah, H., & Abdul-Wahhab, M. M. (2016). Nurses Knowledge toward Essential Care for Adult

Patients Undergoing Mechanical Ventilation at Critical Care Unit in Baghdad City. Higher education, 4(8.0), 100-0.

- Hashemian, S. M., Mortaz, E., Jamaati, H., Bagheri, L., Mohajerani, S. A., Garssen, J., ... & Adcock, I. M. (2018). Budesonide facilitates weaning from mechanical ventilation in difficult-to-wean very severe COPD patients: Association with inflammatory mediators and cells. Journal of critical care, 44, 161-167.
- Hassen, K. A., Nemera, M. A., Aniley, A. W., Olani, A. B., & Bedane, S. G. (2023). Knowledge Regarding Mechanical Ventilation and Practice of Ventilatory Care among Nurses Working in Intensive Care Units in Selected Governmental Hospitals in Addis Ababa, Ethiopia: A Descriptive Cross-Sectional Study. Critical Care Research and Practice, 2023.
- Hesham, S. (2016). Assessment of nurses' performance regarding management of patients on mechanical ventilator. Port Said Scientific Journal of Nursing, 3(1), 161-177.
- Hetland, B., Heusinkvelt, J., Krabbenhoft, L., & Grotts, E. (2018). Mechanical ventilation weaning: an evidence-based review. Nursing2020 Critical Care, 13(6), 5-16.
- Hockenberry, M. J., Bryant, R., & Hellsten, M. B. (2023). Wong's Clinical Manual of Pediatric Nursing E-Book. Elsevier Health Sciences.
- Jackson, M., & Cairns, T. (2021). Care of the critically ill patient. Surgery (Oxford, Oxfordshire), 39(1), 29–36. https://doi.org/10.1016/j.mpsur.2020.11.002
- Mohammed, F. A., & Ebrahem, A. A. (2022). Relationship between Critical Care Nurses' Knowledge and Clinical Decision Making Role in Managing Mechanically Ventilated Patients. Menoufia Nursing Journal, 7(2), 335-350.
- Rak, K. J., Ashcraft, L. E., Kuza, C. C., Fleck, J. C., DePaoli, L. C., Angus, D. C., ... & Kahn, J. M. (2020). Effective care practices in patients receiving prolonged mechanical ventilation. An ethnographic study. American journal of respiratory and critical care medicine, 201(7), 823-831.
- Taha, I., Jawaher, A., Rema, A., Zahrah, A., Yassin, I., & Fatmah, O. (2019). Survival of mechanically ventilated patients admitted to intensive care units. Saudi Medical Journal, 40(8), 781-788.

Annex 1

Table 5: Knowledge of nurses working in intensive care units regarding mechanical ventilation (n=102)

Items	Completely correct answer		Incompletely correct answer		Incorrect / do not know.	
	N	%	N	%	N	%
1. The definition of mechanical ventilation	45	44.1	49	**48.0**	8	7.8
2. Different types of mechanical ventilation	44	43.1	47	**46.1**	11	10.8
3. Indications for Mechanical Ventilation	48	**47.1**	54	52.9	0	0.0
4. Is severe exacerbation of chronic obstructive pulmonary disease (COPD) one indication for Mechanical Ventilation?	9	8.8	78	**76.5**	15	14.7
5. Is barotrauma one indication of Mechanical Ventilation?	9	8.8	79	**77.5**	14	13.7
6. Complications of mechanical ventilation	43	42.2	59	**57.8**	0	0.0
7. The definition of weaning from mechanical ventilation	9	8.8	55	**53.9**	38	37.3
8. Indicators of weaning from mechanical ventilation	51	**50.0**	37	36.3	14	13.7
9. Is one indicator of weaning from mechanical ventilation?	5	4.9	55	**53.9**	42	41.2
10. Is improvement in underlying condition one indicator of weaning from mechanical ventilation?	8	7.8	69	**67.6**	25	24.5
11. Is sufficient respiratory muscle strength one indicator of weaning from mechanical ventilation?	9	8.8	51	**50.0**	42	41.2
12. How to prevent nosocomial infection in mechanically ventilated?	48	47.1	53	**52.0**	1	1.0
13. Prevention of ventilator-associated pneumonia in mechanically ventilated patients	50	49.0	52	**51.0**	0	0.0
14. Signs of adequate ventilation in mechanically ventilated patients	47	46.1	48	**47.1**	7	6.9
15. Signs of inadequate ventilation in mechanically ventilated patients:	38	37.3	64	**62.7**	0	0.0
16. How to maintain airway patent in mechanically ventilated Patient	33	32.4	54	52.9	15	14.7
17. When do endotracheal suction for mechanically ventilated patients?	44	43.1	48	**47.1**	10	9.8
18. The best time to perform chest physiotherapy for mechanically ventilated patients	39	38.2	57	**55.9**	6	5.9
19. The routine method of measuring body temperature for mechanically ventilated patients	43	42.2	46	**45.1**	13	12.7
20. How to prevent oral ulcers in mechanically ventilated neonates	39	38.2	56	**54.9**	7	6.9
Mean ± SD (Range)	23.86±4.73 (1-37)					

Table 5: Practice of nurses working in intensive care units regarding Hand hygiene (n=102)

Hand hygiene	Completely done		Incompletely done		Not done	
	N	%	N	%	N	%
1. Wet hands with clean, running water.	36	35.3	43	**42.2**	23	22.5
2. Apply enough soap to cover all surfaces of hands.	29	28.4	52	**51.0**	21	20.6
3. Rub hands together vigorously for at least 20 seconds, making sure to lather the backs of hands, between fingers, and under nails.	19	18.6	53	**52.0**	30	29.4
4. Rinse hands thoroughly under water	37	36.3	48	**47.1**	17	16.7
5. Dry hands with a clean towel or air dryer.	21	20.6	50	**49.0**	31	30.4
6. Use a towel to turn off the faucet	22	21.6	44	**43.1**	36	35.3
Mean ± SD (Range)			**6.05± 2.25 (2-10)**			

Table 6: Practice of nurses working in intensive care units regarding Measuring Axillary Temperature (n=102)

Measuring Axillary Temperature:	Completely done		Incompletely done		Not done	
	N	%	N	%	N	%
1. Ensure that the patient is in a comfortable position and their armpit is exposed.	44	43.1	58	**56.9**	0	0.0
2. Clean the thermometer probe with an alcohol swab.	29	28.4	52	**51.0**	21	20.6
3. Place the thermometer probe in the patient's armpit, making sure it is in contact with the skin.	28	27.5	44	**43.1**	30	29.4
4. Ask the patient to keep their arm pressed against their side and hold the thermometer in place for the specified time (usually a few minutes).	37	36.3	54	**52.9**	11	10.8
5. Remove the thermometer and read the temperature indicated on the display.	68	**66.7**	34	33.3	0	0.0
6. Document the temperature in the patient's medical records	41	40.2	61	**59.8**	0	0.0
Mean ± SD (Range)			**8.11±2.31 (4-12)**			

Table 7: Practice of nurses working in intensive care units regarding Endotracheal Tube Suctioning (n=102)

Endotracheal Tube Suctioning	Completely done		Incompletely done		Not done	
	N	%	N	%	N	%
1. Perform hand hygiene and put on sterile gloves, a mask, and eye protection.	23	22.5	51	**50.0**	28	27.5
2. Connect the suction catheter to the suction source.	102	**100.0**	0	0.0	0	0.0
3. Lubricate the catheter tip with a water-soluble lubricant.	31	30.4	56	**54.9**	15	14.7
4. Insert the catheter into the endotracheal tube until resistance is felt, then withdraw it slightly.	45	44.1	57	**55.9**	0	0.0
5. Apply intermittent suction while rotating and withdrawing the catheter in a circular motion.	15	14.7	87	**85.3**	0	0.0
6. Limit each suctioning pass to 10-15 seconds to prevent hypoxia and mucosal damage.	25	24.5	36	35.3	41	**40.2**
7. Monitor the patient's oxygen saturation and vital signs during the procedure.	27	26.5	42	**41.2**	33	32.4
8. Repeat the suctioning process as necessary, ensuring that the catheter is cleaned between passes.	17	16.7	46	**45.1**	39	38.2
9. Dispose of the gloves, mask, and other contaminated items appropriately.	24	23.5	55	**53.9**	23	22.5
10. Perform hand hygiene.	31	30.4	24	23.5	47	**46.1**
Mean ± SD (Range)	**11.12±2.78 (5-11)**					

Table 8: Practice of nurses working in intensive care units regarding Chest Physiotherapy (n=102)

Chest Physiotherapy (Postural Drainage and Chest Percussion & Vibration):	Completely done		Incompletely done		Not done	
	N	%	N	%	N	%
1. Position the patient in a comfortable and appropriate postural drainage position based on the target lung segment.	28	27.5	52	**51.0**	22	21.6
2. Perform percussion by rhythmically clapping the chest wall with cupped hands to loosen secretions.	20	19.6	59	**57.8**	23	22.5
3. Follow percussion with vibration, which involves placing hands flat on the chest and using a shaking motion to further dislodge secretions.	14	13.7	54	**52.9**	34	33.3
4. Repeat percussion and vibration in different positions as directed by the healthcare provider or respiratory therapist.	30	29.4	48	**47.1**	24	23.5

5. Encourage the patient to cough or expectorate the loosened secretions.	15	14.7	41	40.2	46	**45.1**
6. Monitor the patient's tolerance and respiratory status throughout the procedure.	16	15.7	35	34.3	51	**50.0**
Mean ± SD (Range)	**5.34 ± 2.19 (2-12)**					

Table 9: Practice of nurses working in intensive care units regarding Intravenous Infusion (n=102)

Intravenous Infusion	**Completely done**		**Incompletely done**		**Not done**	
	N	%	N	%	N	%
Cannula Connection						
• **Perform hand hygiene and put on clean gloves.**	38	37.3	43	42.2	21	20.6
• **Clean the injection port of the IV cannula with an alcohol swab.**	40	39.2	44	43.1	18	17.6
• **Connect the infusion tubing to the cannula by inserting the spike into the port and twisting it securely.**	36	35.3	52	**51.0**	14	13.7
• **Ensure that all connections are tight and secure.**	48	47.1	54	**52.9**	0	0.0
Infusion Steps						
• **Verify the prescribed medication or solution and the rate of infusion.**	18	17.6	84	82.4	0	0.0
• **Open the clamp on the infusion tubing to allow the flow of the medication or solution.**	61	59.8	41	40.2	0	0.0
• **Observe the site for signs of infiltration or other complications.**	28	27.5	41	40.2	33	32.4
• **Monitor the patient's vital signs and assess for any adverse reactions.**	17	16.7	39	38.2	46	45.1
• **Document the infusion details, including the start time and rate, in the patient's medical records.**	24	23.5	55	53.9	23	22.5
Mean ± SD (Range)	**10.52 ± 2.66 (5-17)**					

Table 10: Practice of nurses working in intensive care units regarding Mouth Care (n=102)

Mouth Care	Completely done		Incompletely done		Not done	
	N	%	N	%	N	%
1. Perform hand hygiene and put on clean gloves.	30	29.4	57	**55.9**	15	14.7
2. Assist the patient into a comfortable, upright position.	45	44.1	57	**55.9**	0	0.0
3. Moisten a soft-bristled toothbrush or disposable oral swab with water or a prescribed mouthwash.	13	12.7	75	**73.5**	14	13.7
4. Gently brush the patient's teeth, gums, and tongue using a circular or back-and-forth motion.	24	23.5	36	**35.3**	42	41.2
5. Offer the patient a cup of water or a mouth rinse to rinse and spit out.	27	26.5	42	**41.2**	33	32.4
6. Assist the patient in rinsing and provide a clean container for spitting.	17	16.7	47	**46.1**	38	37.3
7. Clean and store the oral care equipment appropriately.	24	23.5	55	**53.9**	23	22.5
8. Document the mouth care provided in the patient's medical records.	32	31.4	45	**44.1**	25	24.5
Mean ± SD (Range)	**8.21±2.53 (4-14)**					

Table 11: Practice of nurses working in intensive care units regarding Eye Care (n=102)

Eye Care	Completely done		Incompletely done		Not done	
	N	%	N	%	N	%
1. Perform hand hygiene and put on clean gloves.	30	29.4	57	**55.9**	15	14.7
2. Use a clean, soft cloth or sterile saline-soaked gauze to clean the patient's eyelids and lashes, starting from the inner corner and moving outward.	27	26.5	75	**73.5**	0	0.0
3. Use a separate cloth or gauze for each eye to prevent cross-contamination.	38	37.3	24	23.5	40	**39.2**
4. Be gentle and avoid applying excessive pressure to the eye.	38	37.3	44	**43.1**	20	19.6
5. If necessary, instill prescribed eye drops or ointment according to the healthcare provider's instructions.	36	35.3	52	**51.0**	14	13.7
6. Document the eye care provided in the patient's medical records.	32	31.4	45	**44.1**	25	24.5
Mean ± SD (Range)	**6.85±2.17 (2-12)**					

Table 12: Practice of nurses working in intensive care units regarding Positioning (n=102)

Positioning	Completely done		Incompletely done		Not done	
	N	%	N	%	N	%
Assess the patient's mobility and comfort needs.	24	23.5	59	57.8	19	18.6
Assist the patient into a suitable position, considering factors such as pain, respiratory function, pressure ulcer prevention, and overall well-being.	23	22.5	50	49.0	29	28.4
For supine position: Place the patient on their back with their head and shoulders supported by a pillow.	26	25.5	61	59.8	15	14.7
For prone position: Place the patient on their abdomen with their head turned to one side.	36	35.3	60	58.8	6	5.9
For side-lying position: Place the patient on either their left or right side with a pillow supporting their head, upper arm, and upper leg	12	11.8	85	83.3	5	4.9
For Fowler's position: Elevate the head of the bed to a semi-sitting position (usually 45-60 degrees).	23	22.5	56	54.9	23	22.5
For Trendelenburg position: Lower the foot of the bed and elevate the head of the bed to a 15–30-degree angle	24	23.5	57	55.9	21	20.6
For reverse Trendelenburg position: Lower the head of the bed and elevate the foot of the bed to a 15–30-degree angle.	18	17.6	55	53.9	29	28.4
Consider the patient's comfort, safety, and specific medical condition when selecting the appropriate position.	32	31.4	41	40.2	29	28.4
Mean ± SD (Range)			**10.48 ±2.58 (6-18)**			