

Knowledge, Clinical Competence and Barriers among Critical Care Nurses Regarding the Prevention of Ventilator-Associated Pneumonia: An Evidence-Based Narrative Review

Dr. Anwar Shahjad, Associate professor, Medical surgical Dept

Vivek University, Bijnor, Uttar Pradesh

Abstract

Background: Ventilator-associated pneumonia (VAP) is an important healthcare-associated infection affecting patients receiving invasive mechanical ventilation. Critical care nurses have a central role in implementing preventive measures, including patient positioning, oral care, airway management, infection-control practices, mobilisation and coordination of ventilator weaning. However, differences have been reported between nurses' theoretical knowledge, clinical competence and actual adherence to VAP-prevention guidelines.

Objective: This narrative review examined the knowledge, clinical competence and perceived barriers among critical care nurses regarding the prevention of VAP and identified strategies for strengthening evidence-based nursing practice.

Methods: A focused narrative search of PubMed and relevant journal databases was undertaken using terms related to VAP, critical care nurses, knowledge, clinical competence, compliance, barriers and prevention guidelines. Fifteen authoritative guidelines and peer-reviewed studies were selected and narratively synthesised.

Findings: The reviewed evidence demonstrated considerable variation in nurses' knowledge of VAP-prevention recommendations. Frequently identified knowledge gaps involved ventilator-circuit management, suction systems, airway humidification, subglottic secretion drainage and updated oral-care practices. Knowledge did not consistently result in clinical competence or guideline adherence. Major barriers included inadequate education, nursing shortages, workload, lack of equipment, absence of updated protocols, weak supervision, role ambiguity and limited audit feedback. Education was more effective when combined with simulation, competency assessment, adequate resources, checklists and continuing performance monitoring.

Conclusion: Improving VAP prevention requires more than increasing theoretical knowledge. Healthcare institutions should establish updated prevention bundles, competency-based education, direct observation of practice, supportive leadership, adequate staffing and regular audit and feedback.

Keywords: barriers, clinical competence, critical care nurses, intensive care unit, knowledge, nursing practice, ventilator-associated pneumonia

Introduction

Mechanical ventilation is an essential life-support intervention for critically ill patients, but it increases vulnerability to respiratory complications, including ventilator-associated pneumonia. VAP generally refers to pneumonia developing in a patient who has received invasive mechanical ventilation for at least 48 hours. It is associated with increased antibiotic exposure, prolonged ventilation, extended intensive care unit stay and increased healthcare costs. Its diagnosis is challenging because clinical and radiological findings may overlap with other pulmonary conditions.

The prevention of VAP requires coordinated interventions that reduce exposure to mechanical ventilation, limit aspiration of contaminated secretions, maintain oral hygiene and promote early recovery. Updated recommendations emphasise avoiding unnecessary intubation and reintubation, minimising sedation, promoting early mobilisation, elevating the head of the bed, providing regular oral care with toothbrushing, initiating early enteral nutrition and avoiding unnecessary ventilator-circuit changes (Klompas et al., 2022). Subglottic secretion drainage may be considered for patients expected to require prolonged mechanical ventilation.

Critical care nurses are directly responsible for many of these measures. They continuously monitor patients, provide oral and airway care, maintain patient positioning, assist with sedation assessment and weaning, prevent accidental extubation and communicate changes in condition to the multidisciplinary team. Nurses are therefore essential to the success of any VAP-prevention programme.

Nevertheless, possessing information about VAP does not necessarily ensure competent and consistent clinical practice. Clinical competence requires nurses to combine knowledge with technical skill, clinical judgement, communication, accountability and adherence to infection-control principles. This article reviews available evidence regarding nurses' knowledge, clinical competence and barriers related to VAP prevention.

Objective

The objective of this narrative review was to examine the knowledge, clinical competence and barriers among critical care nurses regarding VAP prevention and to identify evidence-based strategies for improving adherence to preventive practices.

Methods

A focused narrative search of PubMed and relevant journal databases was conducted using combinations of the keywords *ventilator-associated pneumonia, VAP prevention, critical care nurses, knowledge, clinical competence, adherence, compliance, barriers, education and ventilator bundle*. Peer-reviewed observational, qualitative and intervention studies examining nurses' knowledge or practices were considered. Current guidance concerning VAP-prevention practices was also included.

Fifteen publications were selected based on relevance to knowledge, clinical practice, competence, barriers and educational interventions. Findings were compared and organised under four areas: knowledge of preventive measures, clinical competence and adherence, barriers to implementation and strategies for practice improvement. This was a focused narrative review rather than a systematic review or meta-analysis.

Knowledge of VAP Prevention among Critical Care Nurses

Knowledge provides the foundation for safe VAP-prevention practices. Nurses should understand the mechanisms through which mechanical ventilation increases infection risk and the rationale behind preventive measures. Important knowledge areas include patient positioning, oral care, secretion management, ventilator-circuit care, airway humidification, sedation reduction, readiness for extubation, enteral feeding and infection-control precautions.

Research has repeatedly demonstrated gaps in nurses' knowledge. Blot et al. (2007) assessed intensive care nurses using an evidence-based knowledge questionnaire and found that although semi-recumbent positioning was widely recognised, knowledge was lower regarding suction systems, humidifier changes and ventilator-circuit management. More experienced nurses and those holding specialised critical care qualifications generally performed better.

A large European study involving intensive care nurses from multiple countries also identified variations in knowledge across preventive measures (Labeau et al., 2008). Nurses were more familiar with visible bedside practices, such as positioning, than with technical recommendations concerning airway equipment. This suggests that frequently performed activities may receive greater attention during clinical orientation than less visible but equally important technical practices.

In Yemen, Al-Sayaghi (2014) found a mean knowledge score of 47.3% among intensive care nurses. Participants demonstrated better knowledge of regular oral care, semi-recumbent positioning, prevention of accidental extubation, removal of ventilator-tubing condensate and assessment of readiness for weaning. Lower knowledge was found regarding humidifier replacement, suction-system changes, kinetic beds and the preferred route of intubation.

Nurses with bachelor's degrees and additional respiratory-care training achieved better scores.

Jansson et al. (2013) reported a mean knowledge score of 59.9% among critical care nurses. Greater clinical experience was associated with better knowledge, but several evidence-based recommendations were not consistently understood or followed. Studies conducted in Jordan, Tanzania and Ethiopia have similarly demonstrated differences in knowledge according to professional education, clinical experience, availability of guidelines and exposure to continuing education (Bankanie et al., 2021; Getahun et al., 2022; Hassan & Wahsheh, 2017).

More recent evidence demonstrates that knowledge remains variable. Yao et al. (2024) found a median knowledge score of seven out of nine among adult intensive care nurses in county-level hospitals in China. Higher knowledge was associated with fewer perceived compliance barriers. Alreshidi et al. (2024) also emphasised the importance of targeted education in strengthening nurses' understanding of VAP-prevention bundles.

Differences in reported knowledge scores should be interpreted cautiously because studies used different questionnaires, scoring systems and guideline versions. Some older assessment tools contain measures that have subsequently changed or become less strongly recommended. Therefore, knowledge questionnaires and training materials should be reviewed regularly to ensure consistency with updated evidence. For example, contemporary guidance recommends regular oral care with toothbrushing but does not support routine oral chlorhexidine use for all mechanically ventilated adults (Klompas et al., 2022).

Clinical Competence and Adherence to Preventive Practices

Clinical competence extends beyond recalling correct answers. It includes the ability to perform preventive interventions safely, recognise contraindications, individualise care, document practice and communicate effectively with the multidisciplinary team. Competent VAP-prevention nursing practice includes maintaining an appropriate head-of-bed position, providing effective oral hygiene, managing secretions aseptically, preventing aspiration, monitoring airway devices and supporting early mobilisation and ventilator liberation.

Nurses must also recognise that some bundle components require interdisciplinary decisions. Sedation reduction, spontaneous awakening and breathing trials, early extubation and mobilisation require collaboration among nurses, physicians, respiratory therapists and physiotherapists. Clinical competence therefore includes leadership and communication rather than merely performing isolated procedures.

Ricart et al. (2003) identified variations in nursing adherence to nonpharmacological VAP-prevention recommendations. Limited resources, patient discomfort, disagreement with guidelines and concerns regarding potential complications influenced adherence. These findings demonstrate that a nurse may know a recommendation but decide not to implement it because of competing clinical priorities or uncertainty about its appropriateness.

Jansson et al. (2013) similarly found a gap between knowledge and adherence. Some practices were frequently implemented despite limited supporting knowledge, whereas other recognised measures were inconsistently performed. This knowledge–practice gap indicates that written examinations alone cannot adequately evaluate competence.

Clinical competence should be assessed through multiple methods. These may include direct observation, return demonstration, simulation, case-based assessment, documentation review and bundle-compliance audits. Self-reported adherence can overestimate actual performance because respondents may provide socially desirable answers or may not recognise deviations from recommended practice.

Paliwal et al. (2023) evaluated knowledge, barriers and ventilator-bundle compliance among nurses and resident doctors in an Indian tertiary-care setting. The findings illustrated the need for education, readily accessible protocols and continuing quality monitoring. Competence assessment should therefore be integrated into orientation, annual appraisal and continuing professional development.

Structured education can improve both knowledge and practice. Aloush (2017) found that educating nurses about VAP-prevention guidelines improved compliance. However, the effect of education may decline when training is delivered as a single event without reinforcement. Wang et al. (2023) demonstrated that a structured training programme improved nurses' theoretical knowledge, technical performance and knowledge–attitude–behaviour scores related to artificial-airway cuff management. These findings support competency-based training that combines theoretical instruction with practical demonstration and assessment.

Barriers to VAP Prevention

Individual and Professional Barriers

Insufficient knowledge, limited critical care experience, lack of confidence and poor understanding of the rationale for preventive measures can reduce adherence. Nurses may continue customary practices learned from senior colleagues even when those practices are inconsistent with current evidence. Negative attitudes, low motivation and a perception that infection prevention is a routine task rather than a patient-safety priority may also influence performance.

Atashi et al. (2018) identified limited professional knowledge, unfavourable attitudes, reduced motivation and inadequate professional accountability as important barriers reported by critical care nurses. These findings indicate that education should address not only knowledge but also professional responsibility and the consequences of inconsistent practice.

Workload and Staffing Barriers

Staff shortages and heavy workloads are among the most frequently reported obstacles. During emergencies, nurses may prioritise haemodynamic stabilisation, medication administration and urgent procedures over oral care, positioning or documentation. Inadequate nurse-to-patient ratios reduce the time available for complete implementation of prevention bundles.

Bankanie et al. (2021) identified lack of skills, inadequate staffing and limited resources as major barriers among intensive care nurses in Tanzania. Similar concerns have been reported in other settings, showing that poor adherence cannot always be attributed to individual nurses.

Environmental and Resource Barriers

The absence of oral-care supplies, suction equipment, subglottic-drainage tubes, functioning beds and personal protective equipment can prevent nurses from implementing recommended practices. Atashi et al. (2018) found that unsuitable physical environments and inadequate equipment contributed to difficulties in preventing VAP.

Limited availability of written protocols also creates variation between staff members and shifts. When guidance is outdated, inaccessible or inconsistent across departments, nurses may rely on personal experience rather than standardised evidence.

Organisational and Leadership Barriers

Weak supervision, inadequate continuing education, limited audit feedback and lack of managerial support can create a culture of inconsistent compliance. Nurses may be unable to identify performance gaps when adherence is not observed or measured.

Atashi et al. (2018) described ineffective human-resource management and insufficient supervision as organisational barriers. Managers should therefore ensure adequate resources, clarify professional roles and respond constructively to identified deficiencies.

Interprofessional Barriers

VAP prevention requires collaboration. Role ambiguity may arise when staff are uncertain about responsibility for oral care, cuff-pressure monitoring, sedation interruption, mobilisation or assessment of extubation readiness. Conflicting instructions from different professionals can reduce consistency. Multidisciplinary protocols and bedside rounds are required to establish shared responsibility.

Strategies for Improving Knowledge and Competence

Healthcare institutions should maintain an updated, locally appropriate VAP-prevention bundle based on current guidance. The bundle should clearly identify essential practices, responsible professionals, contraindications and documentation requirements.

Education should begin during orientation and continue at regular intervals. Effective programmes should include lectures, case discussions, videos, simulation, bedside demonstrations and return demonstrations. Education should focus on the rationale for each intervention because nurses are more likely to apply recommendations when they understand how the intervention reduces risk.

Simulation is particularly useful for oral care, suctioning, airway-cuff management and emergency situations. Competence should be confirmed through observation rather than attendance alone. Aloush (2017) and Wang et al. (2023) demonstrated that structured education can improve compliance and technical performance.

Bedside checklists can support consistent implementation. However, checklists should not become documentation exercises disconnected from actual care. Regular audit and feedback should compare recorded compliance with observed performance. Feedback should be timely, nonpunitive and focused on improvement.

Unit-based VAP champions can provide peer education, answer questions and promote adherence. Managers should ensure adequate staffing and continuous availability of essential supplies. Interprofessional rounds should review sedation, readiness for weaning, mobility, nutrition, head positioning and airway-management needs.

Implications for Critical Care Nursing

Critical care nurses should regard VAP prevention as a continuous safety responsibility rather than a collection of isolated tasks. Nurses should remain updated regarding changing recommendations and participate actively in infection-surveillance and quality-improvement programmes.

Nurse educators should use validated and updated assessment instruments. Hospital administrators should combine knowledge testing with direct competency assessment. Policies should recognise that poor compliance may reflect system failures, including staff shortages, inadequate equipment or unclear responsibilities.

Nursing research should examine the relationship between knowledge, observed competence, bundle adherence and patient outcomes. Multicentre longitudinal studies are needed to determine whether improvements following education are sustained over time.

Limitations

This article is a focused narrative review and not a systematic review. The included studies used different instruments, guideline versions and definitions of competence. Many studies relied on self-reported practice, which may not reflect actual bedside performance. Differences in healthcare systems also limit direct comparison.

Conclusion

Critical care nurses play a decisive role in preventing VAP. Evidence indicates that nurses' knowledge varies considerably and that knowledge alone does not guarantee clinical competence or adherence. Major barriers include inadequate training, staff shortages, workload, limited equipment, outdated protocols, unclear responsibilities and insufficient supervision. Sustainable improvement requires updated guidelines, competency-based education, adequate resources, multidisciplinary cooperation and regular audit with supportive feedback. Strengthening both individual competence and the clinical environment can improve the consistency and safety of VAP-prevention practices.

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