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BEST NURSING PRACTICES FOR REDUCING HEALTHCARE-ASSOCIATED INFECTIONS IN ACUTE CARE SETTINGS: A REVIEW

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ABSTRACT

Healthcare-associated infections (HAIs) remain one of the most significant threats to patient safety worldwide despite substantial advances in infection prevention and control. HAIs increase morbidity, mortality, length of hospital stay, healthcare costs, and antimicrobial resistance, particularly in acute care settings where patients frequently undergo invasive procedures and require complex medical interventions. Nurses constitute the largest proportion of healthcare professionals and play a pivotal role in preventing HAIs through evidence-based infection prevention practices. This review aims to examine current evidence regarding best nursing practices for reducing healthcare-associated infections in acute care hospitals and to identify strategies that improve patient safety and quality of care. A narrative review of recent literature published between 2020 and 2025 was undertaken using electronic databases including PubMed, Scopus, CINAHL, Web of Science, and Google Scholar. International guidelines from the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) were also reviewed. The evidence demonstrates that consistent hand hygiene, appropriate use of personal protective equipment, aseptic technique, environmental cleaning, device-care bundles, antimicrobial stewardship, surveillance, nurse education, and multidisciplinary collaboration significantly reduce the incidence of catheter-associated urinary tract infections, central line-associated bloodstream infections, ventilator-associated pneumonia, and surgical site infections. Emerging technologies such as electronic surveillance systems, artificial intelligence, and digital monitoring tools further strengthen infection prevention efforts by improving compliance and early detection. However, challenges including staff shortages, inadequate resources, inconsistent guideline adherence, and increasing antimicrobial resistance continue to hinder successful implementation. Strengthening nursing competencies, promoting a culture of patient safety, implementing standardized care bundles, and supporting continuous professional education are essential for sustaining infection prevention programs. Evidence-based nursing practice remains the cornerstone of reducing healthcare-associated infections and improving patient outcomes in acute care settings.

Keywords: Healthcare-associated infections, infection prevention, nursing practice, acute care hospitals, patient safety, hand hygiene, infection control, care bundles.

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INTRODUCTION

Healthcare-associated infections (HAIs), also known as nosocomial infections, are infections that develop during the process of receiving healthcare and were neither present nor incubating at the time of admission. They remain among the most common adverse events affecting hospitalized patients worldwide. HAIs represent a substantial burden on healthcare systems because they prolong hospitalization, increase healthcare expenditure, contribute to antimicrobial resistance, and are associated with considerable morbidity and mortality. According to the World Health Organization, hundreds of millions of patients are affected by healthcare-associated infections annually, and many of these infections are preventable through effective infection prevention and control programs. Recent global evidence indicates that strengthened infection prevention measures can substantially reduce infection rates while also lowering healthcare costs and improving patient safety. The burden is particularly high in low- and middle-income countries where resource limitations, overcrowding, and inadequate infection prevention infrastructure remain major challenges. Acute care hospitals provide highly specialized medical and surgical services to patients with complex illnesses requiring invasive diagnostic and therapeutic procedures. The widespread use of urinary catheters, central venous catheters, mechanical ventilation, surgical interventions, and broad-spectrum antibiotics increases patients' vulnerability to healthcare-associated infections. The most frequently reported HAIs include catheter-associated urinary tract infections (CAUTIs), central line-associated bloodstream infections (CLABSIs), ventilator-associated pneumonia (VAP), surgical site infections (SSIs), Clostridioides difficile infection, and infections caused by multidrug-resistant organisms. These infections adversely affect patient recovery by increasing pain, disability, hospital readmission, and mortality while placing significant financial pressure on healthcare institutions. Evidence suggests that a considerable proportion of these infections can be prevented through strict adherence to evidence-based infection prevention measures. Nurses play a central role in infection prevention because they provide continuous bedside care and perform numerous procedures that directly influence infection risk.

Their responsibilities include maintaining hand hygiene, performing aseptic procedures, administering medications safely, monitoring invasive devices, educating patients and families, implementing isolation precautions, recognizing early signs of infection, and collaborating with multidisciplinary healthcare teams. Since nurses spend more time with patients than any other healthcare professional, their compliance with infection prevention guidelines has a direct impact on patient outcomes. Recent umbrella reviews have consistently demonstrated that nurse-led interventions, standardized care bundles, and ongoing competency training contribute significantly to reducing healthcare-associated infections across acute care settings. The COVID-19 pandemic further emphasized the critical importance of

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infection prevention and control within healthcare organizations. Hospitals worldwide strengthened surveillance systems, improved environmental cleaning protocols, expanded personal protective equipment use, and increased education regarding standard precautions. These experiences reinforced the importance of maintaining robust infection prevention programs not only during public health emergencies but also during routine clinical care. International organizations continue to advocate comprehensive infection prevention strategies that integrate leadership commitment, continuous quality improvement, surveillance, antimicrobial stewardship, workforce education, and patient engagement. Despite the availability of comprehensive international guidelines, variation in adherence to infection prevention practices continues to exist. Factors such as heavy workloads, inadequate staffing, insufficient resources, limited education, poor organizational culture, and inconsistent monitoring frequently compromise compliance with evidence-based recommendations. Consequently, identifying effective nursing interventions that consistently reduce healthcare-associated infections remains an important priority for nursing practice, education, administration, and research.

OBJECTIVES

The primary objective of this review is to critically examine current evidence on best nursing practices for reducing healthcare-associated infections (HAIs) in acute care settings. The review aims to synthesize recent literature and evidence-based guidelines that support effective infection prevention and control strategies implemented by nurses to improve patient safety and healthcare quality.

The specific objectives are:

1. To review the epidemiology, burden, and clinical impact of healthcare-associated infections in acute care hospitals.
2. To examine evidence-based nursing interventions, including hand hygiene, standard precautions, aseptic technique, environmental cleaning, and infection prevention care bundles, for reducing HAIs.
3. To evaluate the effectiveness of nurse-led strategies in preventing common healthcare-associated infections such as catheter-associated urinary tract infections (CAUTIs), central line-associated bloodstream infections (CLABSIs), ventilator-associated pneumonia (VAP), and surgical site infections (SSIs).
4. To explore the role of nursing education, competency development, infection surveillance, antimicrobial stewardship, and multidisciplinary collaboration in strengthening infection prevention and control programs.
5. To identify current challenges, barriers, and emerging innovations, including digital health technologies and artificial intelligence that influence the implementation of evidence-based infection

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prevention practices in acute care settings.

6. To provide recommendations for nursing practice, education, administration, and future research aimed at enhancing infection prevention and reducing the burden of healthcare-associated infections in hospitalized patients.

LITERATURE SEARCH METHODOLOGY

This review was conducted using a narrative approach to synthesize current evidence regarding best nursing practices for preventing healthcare-associated infections (HAIs) in acute care settings. A comprehensive literature search was performed using electronic databases, including PubMed, Scopus, CINAHL, Web of Science, ScienceDirect, and Google Scholar. International guidelines published by the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), and the Society for Healthcare Epidemiology of America (SHEA) were also reviewed to ensure that the recommendations reflected current evidence-based infection prevention practices. The search strategy combined Medical Subject Headings (MeSH) and free-text keywords such as healthcare-associated infections, hospital-acquired infections, infection prevention, infection control, nursing practice, hand hygiene, acute care hospitals, catheter-associated urinary tract infection, central line-associated bloodstream infection, ventilator-associated pneumonia, surgical site infection, care bundles, personal protective equipment, environmental cleaning, and antimicrobial stewardship. Boolean operators (AND/OR) were used to refine the search and identify relevant studies.

Articles published in English between January 2020 and June 2025 were considered for inclusion. Eligible publications included systematic reviews, meta-analyses, randomized controlled trials, quasi-experimental studies, observational studies, clinical practice guidelines, and evidence-based recommendations that focused on nursing interventions for preventing HAIs in adult acute care settings. Studies conducted exclusively in long-term care facilities, pediatric hospitals, community healthcare settings, or outpatient clinics were excluded unless their findings were directly applicable to acute hospital practice. The identified literature was screened based on titles, abstracts, and full texts for relevance. Priority was given to high-quality evidence, including systematic reviews, international guidelines, and multicenter studies. Information from the selected articles was synthesized into thematic categories describing evidence-based nursing interventions, implementation strategies, barriers to compliance, and future directions for infection prevention. This narrative synthesis provides an up-to-date overview of nursing practices that have demonstrated effectiveness in reducing HAIs while highlighting opportunities for improving patient safety and quality of care in acute care hospitals.

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BURDEN OF HEALTHCARE-ASSOCIATED INFECTIONS IN ACUTE CARE SETTINGS

Healthcare-associated infections continue to represent one of the greatest challenges to patient safety in hospitals worldwide. Despite significant advances in diagnostic technology, antimicrobial therapy, and infection prevention programs, millions of hospitalized patients develop infections during their hospital stay each year. These infections are associated with increased morbidity, mortality, prolonged hospitalization, readmission, and escalating healthcare costs. The World Health Organization estimates that approximately one in every ten hospitalized patients in low- and middle-income countries acquires at least one healthcare-associated infection, while even high-income countries continue to report substantial infection rates despite well-established infection prevention programs. The growing prevalence of multidrug-resistant organisms has further complicated infection management and increased the urgency for implementing comprehensive prevention strategies.

Patients admitted to acute care hospitals are particularly vulnerable because they frequently undergo invasive diagnostic and therapeutic procedures that compromise natural defense mechanisms. Urinary catheterization, central venous catheter insertion, mechanical ventilation, major surgery, dialysis, and immunosuppressive therapy expose patients to increased infection risks. Older adults, critically ill patients, individuals with chronic illnesses, and immunocompromised patients are especially susceptible to developing HAIs due to impaired immune function and prolonged exposure to healthcare environments. Consequently, preventing infections among these high-risk populations requires continuous nursing surveillance, meticulous aseptic practice, and strict adherence to evidence-based infection control guidelines. The most common healthcare-associated infections include catheter-associated urinary tract infections (CAUTIs), central line-associated bloodstream infections (CLABSIs), ventilator-associated pneumonia (VAP), surgical site infections (SSIs), and Clostridioides difficile infections. Among these, catheter-associated urinary tract infections account for a significant proportion of HAIs because urinary catheterization remains one of the most frequently performed procedures in hospitalized patients. Central line-associated bloodstream infections, although less common, are associated with considerably higher mortality rates and healthcare costs. Ventilator-associated pneumonia remains a major concern in intensive care units because mechanically ventilated patients experience impaired airway defense mechanisms, allowing microorganisms to colonize the lower respiratory tract. Similarly, surgical site infections contribute substantially to postoperative complications, delayed wound healing, prolonged hospitalization, and increased healthcare expenditure. Beyond their clinical consequences, healthcare-associated infections impose enormous economic burdens on healthcare systems. Additional diagnostic investigations, prolonged antimicrobial therapy, intensive care admissions, isolation procedures, and extended hospital stays significantly increase

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healthcare expenditure. Hospitals experiencing high HAI rates also face reduced quality indicators, financial penalties in some healthcare systems, and diminished public confidence. Therefore, preventing infections is not only a patient safety priority but also an important strategy for improving healthcare efficiency and reducing unnecessary costs.

Nurses are uniquely positioned to influence infection prevention because they maintain continuous contact with patients throughout hospitalization. Every nursing intervention, including medication administration, wound dressing, catheter care, intravenous therapy, patient hygiene, and health education, provides opportunities to either prevent or inadvertently transmit microorganisms. Studies consistently demonstrate that hospitals with strong nursing leadership, adequate staffing levels, continuous education, and high compliance with infection prevention protocols experience significantly lower healthcare-associated infection rates. Consequently, strengthening nursing competencies remains one of the most effective and sustainable approaches for improving patient safety in acute care settings. The emergence of antimicrobial resistance has further highlighted the importance of preventing healthcare-associated infections before they occur. Resistant pathogens such as methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant Enterococcus (VRE), carbapenem-resistant Enterobacterales (CRE), and multidrug-resistant Acinetobacter baumannii have become increasingly prevalent within hospitals. These organisms are associated with limited treatment options, longer hospital stays, and higher mortality. Effective nursing infection prevention practices therefore contribute not only to reducing infection incidence but also to limiting the transmission of resistant organisms within healthcare facilities. Given the complexity of modern healthcare, infection prevention requires a multidisciplinary approach involving nurses, physicians, microbiologists, infection prevention specialists, environmental services personnel, pharmacists, and hospital administrators. Nevertheless, nurses remain central to successful implementation because they coordinate bedside care, monitor patient conditions continuously, educate patients and families, and ensure consistent adherence to infection prevention protocols. Strengthening nursing practice through evidence-based interventions is therefore fundamental to reducing the burden of healthcare-associated infections and improving the quality of acute hospital care.

BEST NURSING PRACTICES FOR REDUCING HEALTHCARE-ASSOCIATED INFECTIONS IN ACUTE CARE SETTINGS

HAND HYGIENE: THE FOUNDATION OF INFECTION PREVENTION

Hand hygiene remains the single most effective and cost-efficient intervention for preventing healthcare-associated infections (HAIs) in acute care settings. Since the hands of healthcare workers frequently become contaminated during patient care, proper hand hygiene interrupts the transmission of pathogenic

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microorganisms between patients, healthcare personnel, and the hospital environment. Numerous studies have demonstrated that improved compliance with hand hygiene significantly reduces the incidence of catheter-associated urinary tract infections (CAUTIs), central line-associated bloodstream infections (CLABSIs), ventilator-associated pneumonia (VAP), surgical site infections (SSIs), and infections caused by multidrug-resistant organisms. The World Health Organization (WHO) recommends the "Five Moments for Hand Hygiene," which include before touching a patient, before clean or aseptic procedures, after exposure to body fluids, after touching a patient, and after touching the patient's surroundings. Adherence to these five critical moments has become the international standard for infection prevention. Nurses perform numerous patient care activities throughout each shift, making hand hygiene an integral component of routine clinical practice. Alcohol-based hand rubs are recommended for most clinical situations because they are highly effective, require less time than handwashing with soap and water, and improve compliance among healthcare workers. However, handwashing with soap and water remains essential when hands are visibly soiled or after caring for patients with spore-forming organisms such as Clostridioides difficile. Continuous education, leadership support, availability of hand hygiene facilities, electronic monitoring systems, regular audits, and performance feedback have consistently been associated with improved compliance and lower infection rates. Developing a culture in which hand hygiene is viewed as a professional responsibility rather than a regulatory requirement is essential for sustaining long-term improvements.

STANDARD PRECAUTIONS AND APPROPRIATE USE OF PERSONAL PROTECTIVE EQUIPMENT

Standard precautions constitute the foundation of infection prevention for every patient regardless of diagnosis or infection status. These precautions assume that all blood, body fluids, secretions, excretions, mucous membranes, and non-intact skin may contain infectious microorganisms. Nurses are responsible for consistently implementing standard precautions during every episode of patient care to minimize opportunities for pathogen transmission. Appropriate selection and correct use of personal protective equipment (PPE) represent critical nursing responsibilities. Gloves should be worn whenever contact with blood, body fluids, contaminated equipment, or non-intact skin is anticipated. Masks, respirators, eye protection, and gowns should be selected according to the anticipated mode of transmission and the risk of exposure. Importantly, PPE should complement rather than replace proper hand hygiene. Studies conducted following the COVID-19 pandemic have reinforced the importance of appropriate donning and doffing techniques, as incorrect removal of contaminated PPE remains a major source of self-contamination among healthcare workers. Regular competency assessments, simulation-based training, and visual reminders significantly improve compliance with PPE protocols while

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reducing occupational exposure and healthcare-associated infections.

ASEPTIC TECHNIQUE DURING NURSING PROCEDURES

Maintenance of aseptic technique during invasive procedures remains one of the most important nursing interventions for preventing healthcare-associated infections. Procedures such as intravenous catheter insertion, urinary catheterization, wound dressing, central venous catheter maintenance, medication administration, and specimen collection require meticulous attention to aseptic principles. Failure to maintain sterility during these procedures increases the likelihood of microbial contamination and subsequent infection.

Evidence indicates that standardized aseptic protocols, procedure checklists, and competency-based education significantly reduce contamination during invasive procedures. Nurses should ensure appropriate skin antisepsis using recommended antiseptic agents, maintain sterile fields throughout procedures, minimize unnecessary manipulation of invasive devices, and immediately replace contaminated equipment. Regular observation of clinical practice combined with constructive feedback helps reinforce adherence to aseptic principles and promotes a culture of patient safety.

PREVENTION OF CATHETER-ASSOCIATED URINARY TRACT INFECTIONS

Catheter-associated urinary tract infections remain among the most common healthcare-associated infections in acute care hospitals because urinary catheters are frequently used for patient monitoring and management. However, prolonged catheterization substantially increases the risk of bacterial colonization and infection. Evidence consistently demonstrates that a large proportion of CAUTIs are preventable through nurse-led interventions.

Best nursing practices include avoiding unnecessary catheterization, using evidence-based indications for catheter insertion, maintaining strict aseptic technique during insertion, securing the catheter properly to prevent movement, maintaining a closed drainage system, ensuring unobstructed urine flow, positioning the drainage bag below bladder level, and performing daily assessments of catheter necessity. Daily nurse-led reminders and automatic stop orders encouraging early catheter removal have significantly reduced catheter utilization and infection rates. Patient and family education regarding catheter care further enhances infection prevention by encouraging early reporting of catheter-related complications.

PREVENTION OF CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS

Central venous catheters provide essential vascular access for critically ill patients but also represent an important source of bloodstream infections. CLABSIs are associated with high mortality, prolonged hospitalization, and substantial healthcare costs. Consequently, implementation of evidence-based

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central line care bundles has become a major quality improvement priority in hospitals worldwide. Nursing interventions include strict hand hygiene before catheter manipulation, maximal sterile barrier precautions during insertion, chlorhexidine skin antisepsis, selection of appropriate catheter insertion sites, sterile dressing changes, routine assessment of catheter necessity, and prompt removal of unnecessary catheters. Nurses should inspect catheter insertion sites daily for signs of infection, maintain dressing integrity, disinfect catheter hubs before each access, and document catheter care consistently. Hospitals implementing multidisciplinary CLABSI prevention bundles with active nursing participation have reported sustained reductions in bloodstream infection rates, emphasizing the importance of standardized nursing practice.

PREVENTION OF VENTILATOR-ASSOCIATED PNEUMONIA

Ventilator-associated pneumonia remains one of the most serious complications affecting mechanically ventilated patients in intensive care units. The presence of an artificial airway bypasses normal respiratory defense mechanisms, facilitating bacterial colonization of the lower respiratory tract. VAP contributes to increased mortality, prolonged intensive care stays, and higher healthcare costs. Evidence strongly supports the implementation of ventilator care bundles to reduce VAP incidence. Nursing responsibilities include maintaining the head of the bed elevated between 30 and 45 degrees, providing regular oral care with chlorhexidine when indicated by institutional policy, minimizing sedation, encouraging daily spontaneous awakening and breathing trials in collaboration with physicians, maintaining endotracheal cuff pressure appropriately, preventing aspiration of gastric contents, and ensuring proper management of ventilator circuits. Continuous assessment of respiratory status and early mobilization of mechanically ventilated patients further contribute to improved pulmonary function and reduced infection risk.

PREVENTION OF SURGICAL SITE INFECTIONS

Surgical site infections remain among the leading causes of postoperative complications worldwide. Nurses contribute to SSI prevention throughout the preoperative, intraoperative, and postoperative periods. Evidence-based nursing interventions begin with patient education regarding skin preparation, smoking cessation, nutritional optimization, and glycemic control before surgery. During the perioperative period, nurses ensure adherence to sterile technique, maintain normothermia, support appropriate antibiotic timing, and minimize unnecessary operating room traffic. Following surgery, careful wound assessment, aseptic dressing changes, early recognition of infection signs, patient education regarding wound care, and timely communication with surgical teams contribute significantly to reducing postoperative infections. Standardized SSI prevention bundles have consistently demonstrated reductions in infection rates when implemented with high nursing compliance.

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CONCLUSION

Healthcare-associated infections (HAIs) continue to be a major challenge to patient safety and healthcare quality in acute care settings, contributing to increased morbidity, mortality, prolonged hospitalization, antimicrobial resistance, and rising healthcare costs. Despite these challenges, a substantial proportion of HAIs are preventable through the consistent implementation of evidence-based nursing practices. As frontline healthcare professionals, nurses play a pivotal role in interrupting the transmission of infectious microorganisms and ensuring the delivery of safe, high-quality patient care. Their continuous presence at the bedside places them in a unique position to implement infection prevention strategies, monitor patients for early signs of infection, educate patients and caregivers, and promote adherence to standardized infection control protocols. The evidence reviewed demonstrates that fundamental nursing interventions including strict hand hygiene, adherence to standard and transmission-based precautions, appropriate use of personal protective equipment, maintenance of aseptic technique, environmental cleaning, and the implementation of evidence-based care bundles are highly effective in reducing the incidence of common healthcare-associated infections such as catheter-associated urinary tract infections, central line-associated bloodstream infections, ventilator-associated pneumonia, and surgical site infections. These interventions are further strengthened through continuous professional education, competency-based training, regular compliance audits, infection surveillance systems, multidisciplinary collaboration, and leadership support. Hospitals that foster a strong culture of patient safety and accountability consistently report lower infection rates and better clinical outcomes. Emerging technologies, including electronic surveillance systems, digital compliance monitoring, artificial intelligence, and clinical decision-support tools, offer promising opportunities to enhance infection prevention programs. These innovations can improve early detection of infection risks, support timely clinical decision-making, facilitate real-time monitoring of adherence to infection control practices, and optimize resource utilization. However, successful integration of these technologies requires adequate infrastructure, ongoing staff training, and institutional commitment to quality improvement. Despite considerable progress, several barriers continue to impede the effective implementation of infection prevention practices. Inadequate staffing, heavy workloads, limited resources, inconsistent adherence to guidelines, and the growing threat of antimicrobial resistance remain significant concerns, particularly in resource-constrained healthcare settings. Addressing these challenges requires sustained investment in nursing workforce development, standardized infection prevention policies, strong organizational leadership, and continuous quality improvement initiatives. Policymakers and healthcare administrators should prioritize infection prevention as a strategic objective by ensuring sufficient staffing levels, providing access to essential infection control resources, and

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supporting ongoing education and professional development for nurses.

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