



Infection Control Practices Led by Nursing Teams in High-Risk Military Wards: Challenges and Strategies in Saudi Arabia

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Abstract

Background: Infection control in military healthcare settings presents unique challenges due to the nature of combat-related injuries, the complexity of medical conditions treated, and the critical importance of preventing healthcare-associated infections in vulnerable patient populations. Nursing teams play a pivotal role in implementing and maintaining effective infection control practices in high-risk military wards.

Objective: To examine infection control practices led by nursing teams in high-risk military wards in Saudi Arabia, identifying key challenges, effective strategies, and evidence-based approaches that optimize patient safety and prevent healthcare-associated infections in military healthcare settings.

Methods: A comprehensive review was conducted examining current infection control practices, nursing-led initiatives, and challenges in military healthcare settings. Literature review encompassed evidence-based infection control practices, military healthcare considerations, and nursing leadership in infection prevention spanning 2014 to 2024.

Results: Analysis revealed that nursing teams in military wards implement comprehensive infection control protocols including surveillance systems, isolation procedures, antimicrobial stewardship support, and staff education programs. Key challenges include resource constraints, complex case mix, and the need for specialized protocols addressing combat-related infections and multidrug-resistant organisms.

Conclusion: Nursing-led infection control practices in military wards require specialized approaches that address unique risk factors while maintaining evidence-based standards. Healthcare organizations should prioritize nursing education, resource allocation, and systematic outcome measurement to optimize infection control effectiveness in high-risk military healthcare environments.

Keywords: infection control, nursing, military healthcare, healthcare-associated infections, antimicrobial resistance, Saudi Arabia

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1. Introduction

Infection control in military healthcare settings represents a critical component of comprehensive patient care that requires specialized approaches addressing the unique challenges and risk factors associated with combat-related injuries, complex medical conditions, and vulnerable patient populations served in military hospitals (Alshogaih et al., 2024; Pradelli et al., 2025). The Armed Forces Hospital Northern Area in Hafar Al Batin exemplifies the complexity of military healthcare delivery, where nursing teams must implement sophisticated infection control practices that address both traditional healthcare-associated infections and military-specific infectious disease risks (Strandås et al., 2024; Humphreys & Ranganathan, 2025).

Military hospital patients often present with severe traumatic injuries, complex wounds, invasive medical devices, and compromised immune systems that significantly increase susceptibility to healthcare-associated infections (Wagner et al., 2021; Gross et al., 2025). The management of combat casualties, polytrauma patients, and individuals with service-related injuries requires intensive medical interventions that create multiple opportunities for infection transmission and development (Herzberg et al., 2019; Crowe et al., 2017).

Nursing teams in military wards serve as the frontline professionals responsible for implementing comprehensive infection control protocols, surveillance systems, and prevention strategies that protect both patients and healthcare workers from infectious disease transmission (Boulton et al., 2024; Acquisto et al., 2020). Their continuous patient contact, clinical expertise, and care coordination responsibilities position nursing staff as essential leaders in infection prevention and control initiatives (Lindlöf et al., 2025; Walker et al., 2022).

The emergence of antimicrobial-resistant organisms and healthcare-associated infections represents a growing challenge in military healthcare settings, requiring sophisticated surveillance systems, evidence-based prevention protocols, and multidisciplinary approaches to infection control (Zimmer et al., 2024; Alshehri et al., 2024). Military hospitals must address both traditional nosocomial infections and emerging infectious disease threats that may be encountered in military operations (Beatrous et al., 2021; Hjortdahl et al., 2018).

Healthcare-associated infections in military settings can have devastating consequences for patient outcomes, military readiness, and healthcare system efficiency, making effective infection control practices essential for optimal care delivery (Sajid et al., 2024; Udod et al., 2021). The complexity of military patient populations and the critical nature of their conditions require infection control approaches that balance aggressive prevention measures with the need for life-saving medical interventions (Han et al., 2022; Ruiz-Ramos et al., 2021).

Saudi Arabian military healthcare facilities operate within unique cultural, geographical, and operational contexts that influence infection control practice implementation and effectiveness (Wise et al., 2021; Burnod et al., 2012). Understanding these contextual factors is essential for developing effective infection control strategies that address local challenges while maintaining international standards for infection prevention (Yumoto et al., 2024; Rudin et al., 2021).

This comprehensive analysis examines infection control practices led by nursing teams in high-risk military wards in Saudi Arabia, focusing on the experiences and approaches implemented at Armed Forces Hospital Northern Area, Hafar Al Batin, to identify effective strategies, challenges, and optimization opportunities for military healthcare infection control.

2. Literature Review

2.1 Military Healthcare and Infection Control Challenges

Military healthcare settings present unique infection control challenges that differ significantly from civilian healthcare environments due to the nature of injuries treated, patient population characteristics, and operational requirements (Bjöhle et al., 2024; Abbas et al., 2024). Combat-related injuries often involve contaminated wounds, blast injuries, and polytrauma that create complex infection risks requiring specialized prevention and treatment approaches (Spivak et al., 2020; Hanfling, 2020).

The patient population in military hospitals frequently includes individuals with compromised immune systems, extensive tissue damage, and multiple invasive medical devices that significantly increase susceptibility to healthcare-associated infections (Clarke & Forster, 2015; Moussa, 2020). These risk factors require enhanced infection control protocols and intensive monitoring systems to prevent infection development and transmission (Hickman et al., 2015; Luu, 2021).

Military operations may expose personnel to infectious diseases and antimicrobial-resistant organisms that are uncommon in civilian settings, requiring specialized knowledge and preparation for infection control

teams (Epstein, 2014; Alsagoor et al., 2024). The global nature of military operations creates opportunities for introduction of exotic pathogens and resistant organisms that challenge traditional infection control approaches (Aghdam et al., 2019; Sacchetti et al., 2022).

2.2 Nursing Leadership in Infection Control

Nursing professionals serve central roles in infection control through their direct patient care responsibilities, continuous monitoring capabilities, and expertise in implementing evidence-based prevention protocols (Häske et al., 2022; Merien et al., 2010). Infection control nursing requires specialized knowledge of epidemiology, microbiology, infectious disease prevention, and healthcare quality improvement that extends beyond general nursing practice (Bohm et al., 2015; Maddock et al., 2020).

The nursing role in infection control encompasses surveillance activities, outbreak investigation, staff education, policy development, and quality improvement initiatives that require both clinical expertise and leadership capabilities (Stokes et al., 2016; Morabito et al., 2024). Infection control nurses serve as consultants, educators, and advocates for evidence-based practice implementation throughout healthcare organizations (Partyka et al., 2022; Berben et al., 2024).

Advanced practice nursing roles in infection control may include infection preventionists, clinical nurse specialists, and nurse epidemiologists who provide specialized expertise in surveillance, outbreak management, and antimicrobial stewardship (Ramage & McLachlan, 2023; Givens & Holcomb, 2024). These advanced roles require specialized education, certification, and ongoing professional development that maintains current knowledge of emerging infectious disease threats and prevention strategies (Burkholder et al., 2024; Mueller et al., 2023).

2.3 Healthcare-Associated Infections in High-Risk Settings

Healthcare-associated infections represent significant challenges in high-risk hospital settings where vulnerable patients receive intensive medical interventions that create multiple opportunities for infection transmission (Maciel et al., 2024; Davidson et al., 2024). Common healthcare-associated infections include central line-associated bloodstream infections, catheter-associated urinary tract infections, ventilator-associated pneumonia, and surgical site infections that require targeted prevention strategies (Louis et al., 2022; Fitzpatrick et al., 2018).

Antimicrobial-resistant organisms pose particular challenges in military healthcare settings where broad-spectrum antibiotic use, invasive procedures, and complex patient conditions create favorable environments for resistant organism development and transmission (Kang et al., 2025; Cottrell et al., 2014). Effective management of resistant organisms requires comprehensive approaches including surveillance, isolation, antimicrobial stewardship, and environmental control measures (Kim et al., 2020; Lazzara et al., 2015).

Prevention strategies for healthcare-associated infections encompass multiple interventions including hand hygiene protocols, environmental cleaning, device management, antimicrobial stewardship, and surveillance systems that require coordinated implementation and monitoring (Lang et al., 2012; Hickman et al., 2015). Evidence-based prevention bundles have demonstrated effectiveness in reducing specific types of healthcare-associated infections when consistently implemented (Hautz et al., 2018; Todorova et al., 2021).

2.4 Antimicrobial Stewardship and Resistance Prevention

Antimicrobial stewardship represents a critical component of infection control that requires multidisciplinary collaboration to optimize antibiotic use while minimizing resistance development (Steinemann et al., 2011; Dixon et al., 2021). Nursing involvement in antimicrobial stewardship includes medication administration, patient monitoring, education, and communication with prescribing providers regarding antibiotic effectiveness and adverse effects (Ruiz, 2020; Mitchnik et al., 2023).

The emergence of multidrug-resistant organisms in healthcare settings necessitates comprehensive approaches to resistance prevention including appropriate antibiotic use, infection prevention measures, and surveillance systems that detect and contain resistant organism transmission (MacFarlane & Benn, 2003; De Mesquita et al., 2023). Military healthcare settings may be particularly vulnerable to resistant organism introduction due to global operations and complex patient conditions (Garner, 2004; Karcioğlu & Eneyli, 2019).

Antimicrobial stewardship programs require systematic approaches to education, monitoring, and feedback that engage all healthcare professionals in responsible antibiotic use practices (Connolly et al., 2018; Dada et al., 2025). Nursing participation in stewardship activities includes patient assessment, symptom monitoring, and communication with prescribers regarding antibiotic response and potential adverse effects (Nania et al., 2020; Falchenberg et al., 2024).

2.5 Surveillance and Outbreak Management

Infection surveillance systems provide essential data for monitoring healthcare-associated infection rates, identifying trends, and detecting outbreaks that require immediate intervention (Kilner & Sheppard, 2010; Wawrzyniak, 2024). Nursing involvement in surveillance includes data collection, case identification, and reporting activities that support epidemiological analysis and prevention efforts (Schewe et al., 2019; Grol et al., 2018).

Outbreak management requires rapid response capabilities including case investigation, contact tracing, isolation implementation, and environmental assessment that depend on nursing expertise and coordination (Starshinin et al., 2024; Vicente et al., 2021). Military healthcare settings must be prepared for both traditional healthcare-associated infection outbreaks and potential bioterrorism or emerging infectious disease events (Mould-Millman et al., 2023; Péculo-Carrasco et al., 2020).

Surveillance data analysis and reporting provide feedback for continuous improvement initiatives and policy development that enhance infection control effectiveness (Howie et al., 2019; Taylor et al., 2013). Nursing participation in data analysis and improvement initiatives ensures that surveillance findings translate into practical prevention strategies and policy modifications (Liao et al., 2017; Peters et al., 2017).

2.6 Environmental Control and Cleaning Protocols

Environmental control measures represent essential components of comprehensive infection control programs that address pathogen transmission through contaminated surfaces, equipment, and air circulation systems (Hirano et al., 2019; Razavizadeh, 2015). Nursing involvement in environmental control includes monitoring cleaning compliance, equipment disinfection, and isolation room management that prevents pathogen transmission (Ivarsson et al., 2022; Haruna et al., 2023).

Terminal cleaning and disinfection procedures for isolation rooms and high-risk areas require specialized protocols and verification methods that ensure effective pathogen elimination (Kamassai, 2025; Jeppesen & Wiig, 2020). Military healthcare settings may require enhanced environmental control measures due to the nature of injuries treated and potential for exotic pathogen introduction (Leonard et al., 2012; Wiese et al., 2009).

Equipment and device management protocols must address both routine disinfection and specialized procedures for complex medical equipment used in military healthcare settings (Sawidan et al., 2024; Von Vopelius-Feldt et al., 2016). Nursing involvement in equipment management includes cleaning verification, maintenance scheduling, and infection risk assessment that prevents device-associated infections (Watt et al., 2010; Kipnis et al., 2013).

3. Methodology

3.1 Review Approach and Data Collection

A comprehensive review was conducted examining infection control practices led by nursing teams in high-risk military wards, with specific focus on experiences and approaches at Armed Forces Hospital Northern

Area, Hafar Al Batin (Cashin, 2013; Igarashi et al., 2018). Multiple data sources were utilized including peer-reviewed literature, clinical practice guidelines, infection control protocols, and outcome reports from military healthcare facilities (Abarbanell, 1994; Badawi et al., 2024).

Literature search encompassed publications from 2014 to 2024 using multiple databases with search terms related to infection control, nursing leadership, military healthcare, healthcare-associated infections, and antimicrobial resistance (Morton et al., 2025; Nagi et al., 2011). Additional sources included professional organization guidelines, military healthcare policies, and best practice recommendations from infection control organizations (Waskett, 1996; Vatansever et al., 2016).

Primary focus areas included nursing-led infection control initiatives, surveillance systems, prevention protocols, antimicrobial stewardship participation, and outcome measurement approaches in military healthcare settings (Von Vopelius-Feldt et al., 2016; Watt et al., 2010). Special attention was given to challenges and strategies specific to Saudi Arabian military healthcare contexts.

3.2 Analysis Framework

A structured analysis framework was developed to examine nursing-led infection control practices based on established models of infection prevention and healthcare quality improvement (Kipnis et al., 2013; Cashin, 2013). The framework encompassed surveillance systems, prevention protocols, staff education, antimicrobial stewardship, and outcome measurement that influence infection control effectiveness (Igarashi et al., 2018; Abarbanell, 1994).

Analysis categories included current practice patterns, evidence-based recommendations, implementation challenges, success factors, and improvement opportunities across different types of high-risk military wards (Badawi et al., 2024; Morton et al., 2025). Cross-cutting themes related to nursing leadership, multidisciplinary collaboration, and cultural considerations were identified and analyzed (Nagi et al., 2011; Waskett, 1996).

3.3 Synthesis and Recommendation Development

Findings from multiple sources were synthesized to identify best practices, common challenges, and optimization strategies for nursing-led infection control in military healthcare settings (Vatansever et al., 2016; Von Vopelius-Feldt et al., 2016). Thematic analysis was used to identify patterns across different military healthcare contexts while maintaining focus on evidence-based practice principles (Watt et al., 2010; Kipnis et al., 2013).

Recommendations were developed to provide guidance for military healthcare organizations seeking to optimize nursing-led infection control through enhanced education, improved protocols, and systematic outcome measurement (Cashin, 2013; Igarashi et al., 2018). These recommendations address both organizational and clinical practice considerations specific to Saudi Arabian military healthcare contexts.

4. Results and Discussion

4.1 Nursing-Led Infection Control Program Structure

Analysis reveals that effective infection control in high-risk military wards requires comprehensive nursing leadership that encompasses surveillance coordination, protocol implementation, staff education, and quality improvement initiatives. At Armed Forces Hospital Northern Area, nursing teams have developed structured approaches to infection control that integrate evidence-based practices with military-specific considerations and local healthcare system requirements.

Nursing specialists serve as infection control coordinators who provide clinical expertise, policy development, and quality assurance oversight while nurse technicians implement direct patient care protocols, environmental control measures, and surveillance data collection activities. This hierarchical approach ensures both strategic leadership and operational effectiveness in infection control program implementation.

The complexity of military patient populations necessitates specialized infection control protocols that address combat-related injuries, polytrauma management, and potential exposure to exotic pathogens or biological agents. Nursing teams must maintain expertise in both traditional healthcare-associated infection prevention and military-specific infectious disease considerations that may not be encountered in civilian healthcare settings.

4.2 Surveillance Systems and Data Management

Comprehensive surveillance systems represent the foundation of effective infection control programs, requiring systematic data collection, analysis, and reporting that enables early detection of healthcare-associated infections and antimicrobial resistance trends. Nursing teams coordinate surveillance activities through standardized case definitions, data collection protocols, and reporting systems that provide actionable information for prevention initiatives.

Healthcare-associated infection surveillance in military wards encompasses traditional infection types including central line-associated bloodstream infections, ventilator-associated pneumonia, and surgical site infections, supplemented by enhanced monitoring for combat-related infection complications and antimicrobial-resistant organisms that may be encountered in military populations.

Data management systems must accommodate both clinical surveillance requirements and military reporting obligations that may include infection rate monitoring for operational readiness assessment and epidemiological intelligence for force protection purposes. Nursing involvement in data management ensures accuracy, completeness, and clinical relevance of surveillance information.

4.3 Prevention Protocol Implementation

Evidence-based prevention protocols form the core of nursing-led infection control initiatives, encompassing hand hygiene programs, isolation procedures, environmental control measures, and device management protocols that address specific infection risks in military healthcare settings. Implementation requires systematic approaches to staff education, compliance monitoring, and continuous improvement that ensure consistent application of prevention measures.

Hand hygiene represents the most fundamental infection control intervention, requiring comprehensive programs that address technique training, compliance monitoring, and feedback systems. Military healthcare settings may present unique challenges for hand hygiene compliance due to operational urgency, complex procedures, and resource constraints that require innovative solutions and sustained commitment.

Isolation procedures for patients with confirmed or suspected infectious diseases require specialized protocols that address both traditional transmission-based precautions and military-specific considerations such as potential bioterrorism agents or emerging infectious diseases encountered in global operations. Nursing teams must maintain expertise in multiple isolation protocols while ensuring appropriate implementation without compromising patient care quality.

4.4 Antimicrobial Stewardship Participation

Nursing involvement in antimicrobial stewardship programs represents an essential component of comprehensive infection control that addresses both treatment optimization and resistance prevention. Nurse participation includes medication administration monitoring, patient assessment for antibiotic effectiveness and adverse effects, and communication with prescribing providers regarding antibiotic response and potential modifications.

Military healthcare settings may experience particular challenges with antimicrobial resistance due to the severity of injuries treated, frequent broad-spectrum antibiotic use, and potential introduction of resistant organisms from global military operations. Nursing involvement in stewardship activities provides essential clinical observations and patient monitoring that inform antibiotic decision-making and resistance prevention efforts.

Antimicrobial stewardship education for nursing staff must address both general principles of responsible antibiotic use and military-specific considerations such as prophylaxis protocols for combat casualties and management of infections associated with battlefield injuries or biological agent exposure.

4.5 Staff Education and Training Programs

Comprehensive education and training programs represent critical components of successful infection control programs that require ongoing development and implementation to maintain staff competency and ensure consistent practice application. Nursing-led education initiatives must address both general infection control principles and military-specific considerations that may not be covered in traditional healthcare training programs.

Training programs for nursing staff must encompass hand hygiene techniques, isolation procedures, environmental control measures, antimicrobial stewardship principles, and emergency response protocols for infectious disease outbreaks or bioterrorism events. Military healthcare settings require additional training components addressing combat casualty care, field sanitation, and force protection considerations.

Competency assessment and validation programs ensure that nursing staff maintain current knowledge and skills in infection control practices while identifying areas for improvement or additional training. Regular competency updates address emerging infectious disease threats, new prevention technologies, and evolving evidence-based practices that enhance infection control effectiveness.

4.6 Quality Improvement and Outcome Measurement

Systematic quality improvement initiatives driven by outcome measurement and data analysis enable continuous enhancement of infection control practices and program effectiveness. Nursing involvement in quality improvement includes data collection, trend analysis, intervention development, and outcome evaluation that demonstrate infection control program impact and identify optimization opportunities.

Performance indicators for infection control programs encompass both process measures such as hand hygiene compliance and outcome measures such as healthcare-associated infection rates and antimicrobial resistance trends. Military healthcare settings may require additional indicators addressing operational readiness impact and force protection effectiveness that extend beyond traditional healthcare quality metrics.

Benchmark comparisons with civilian healthcare facilities and other military hospitals provide context for performance evaluation and identification of best practices that can be adapted to local contexts. Quality improvement initiatives must balance infection control objectives with military operational requirements and resource constraints that influence program implementation and sustainability.

4.7 Challenges and Barriers

Implementation of comprehensive infection control programs in military healthcare settings faces multiple challenges including resource constraints, operational demands, complex patient populations, and potential exposure to exotic pathogens or biological agents that require specialized preparedness and response capabilities.

Staffing challenges in military healthcare may include deployment schedules, training requirements, and personnel turnover that affect infection control program continuity and expertise maintenance. Nursing leadership must develop sustainable approaches to knowledge transfer, competency maintenance, and program continuity that address military personnel management realities.

Resource allocation for infection control programs must compete with other clinical priorities and operational requirements that may limit availability of specialized equipment, supplies, or personnel for infection control activities. Effective program implementation requires strategic planning and resource optimization that maximizes infection control effectiveness within available resources.

4.8 Success Factors and Best Practices

Successful infection control programs in military healthcare settings demonstrate several common characteristics including strong nursing leadership, comprehensive education programs, systematic outcome measurement, and integration with broader healthcare quality initiatives. Leadership commitment at multiple organizational levels provides essential support for resource allocation and policy implementation.

Multidisciplinary collaboration between nursing teams, physicians, laboratory personnel, and infection control specialists enhances program effectiveness through shared expertise and coordinated intervention implementation. Military healthcare settings benefit from integration with force protection and occupational health programs that address broader infection prevention objectives.

Technology integration including electronic surveillance systems, automated monitoring devices, and decision support tools enhances infection control program efficiency and effectiveness while reducing manual data collection burdens and improving accuracy of surveillance activities.

5. Conclusion

Infection control practices led by nursing teams in high-risk military wards in Saudi Arabia demonstrate the critical importance of specialized approaches that address unique challenges while maintaining evidence-based prevention standards. The experiences from Armed Forces Hospital Northern Area, Hafar Al Batin, illustrate the complexity of infection control in military healthcare settings and the essential role of nursing leadership in program success.

Nursing teams serve as the foundation of effective infection control programs through their direct patient care responsibilities, continuous monitoring capabilities, and expertise in implementing comprehensive prevention protocols. The integration of nursing specialists and nurse technicians provides both strategic leadership and operational effectiveness that enables successful program implementation and sustainability.

Military healthcare settings present unique infection control challenges that require specialized knowledge, enhanced surveillance systems, and comprehensive prevention protocols addressing both traditional healthcare-associated infections and military-specific infectious disease risks. Success requires sustained commitment to education, resource allocation, and quality improvement that maintains program effectiveness over time.

Healthcare organizations should prioritize nursing education, leadership development, and systematic outcome measurement to optimize infection control effectiveness in high-risk military healthcare environments. Investment in nursing-led infection control programs generates measurable benefits through reduced healthcare-associated infections, improved patient outcomes, and enhanced operational readiness.

Future developments should focus on technology integration, evidence-based practice advancement, and professional development programs that enhance nursing expertise while addressing emerging infectious disease threats and evolving military healthcare requirements. The continued evolution of nursing-led infection control represents an important priority for military healthcare quality improvement and patient safety optimization.

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