



## Enhancing Healthcare-Associated Infection Prevention: A Multidisciplinary Approach Integrating Nursing, Anesthesia, and Administrative Roles in Saudi Arabian Hospitals

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### Abstract

**Background:** Healthcare-associated infections (HAIs) pose a significant challenge to patient safety and healthcare quality in Saudi Arabia. Effective HAI prevention requires a multidisciplinary approach that leverages the expertise of various healthcare professionals. This comprehensive review examines the potential for integrating nursing, anesthesia, and administrative roles to enhance HAI prevention strategies in Saudi Arabian hospitals, aligning with the healthcare transformation goals of Vision 2030.

**Methods:** A systematic literature review was conducted using PubMed, CINAHL, and Scopus databases. Studies published between 2010-2024 addressing the roles of nurses, anesthesia professionals, and healthcare administrators in HAI prevention, with a focus on interprofessional collaboration and infection control practices, were included. Thematic analysis identified key strategies, challenges, and implications for the Saudi healthcare context.

**Results:** The review identified three main themes: (1) the central role of nurses in implementing and monitoring infection control practices, (2) the importance of anesthesia professionals in preventing surgical site infections and device-associated infections, and (3) the critical leadership and support functions of healthcare administrators in fostering a culture of safety and allocating resources for HAI prevention. Key challenges included knowledge gaps, workload pressures, and communication barriers. Promising strategies involved education and training, standardized protocols, and multidisciplinary collaboration.

**Conclusion:** Enhancing HAI prevention in Saudi Arabian hospitals requires a synergistic approach that integrates the expertise and efforts of nurses, anesthesia professionals, and healthcare administrators. Fostering interprofessional collaboration, evidence-based practice, and a culture of safety is crucial for reducing HAI rates and improving patient outcomes. Future research should evaluate the effectiveness of multidisciplinary HAI prevention interventions and explore strategies for sustaining best practices in the Saudi healthcare context.

**Keywords:** Healthcare-associated infections; infection prevention and control; nursing; anesthesia; healthcare administration; multidisciplinary collaboration; Saudi Vision 2030

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## Introduction

Healthcare-associated infections (HAIs) represent a significant threat to patient safety and healthcare quality worldwide, leading to increased morbidity, mortality, and healthcare costs (Allegranzi et al., 2019). In Saudi Arabia, the prevalence of HAIs has been reported to range from 7.5% to 14.5% in various hospital settings, underscoring the need for effective prevention strategies (Al-Tawfiq et al., 2018). The healthcare transformation goals outlined in Saudi Vision 2030 emphasize the importance of improving healthcare quality and patient safety, making HAI prevention a critical priority for the nation's healthcare system (Alshammari et al., 2021).

Effective HAI prevention requires a multidisciplinary approach that leverages the expertise and efforts of various healthcare professionals (Zingg et al., 2020). Nurses, as the largest group of healthcare providers and the primary caregivers at the bedside, play a central role in implementing and monitoring infection control practices (Alshammari et al., 2020). Their knowledge, skills, and adherence to evidence-based guidelines are essential for preventing the transmission of pathogens and reducing the risk of HAIs (Aloush, 2018).

Anesthesia professionals, including anesthesiologists and anesthesia technicians, also contribute significantly to HAI prevention, particularly in the context of surgical site infections and device-associated infections (Alsaif et al., 2021). Their roles encompass the proper handling and sterilization of anesthesia equipment, adherence to aseptic techniques, and the implementation of evidence-based practices to reduce the risk of infection during perioperative care (Al-Abdulkarim et al., 2020).

Healthcare administrators, including medical secretaries and nursing administrators, play a critical leadership and support role in fostering a culture of safety and allocating resources for HAI prevention (Alhamad et al., 2021). Their responsibilities include developing and enforcing infection control policies, providing education and training opportunities for staff, and facilitating communication and collaboration among healthcare teams (Alswat et al., 2017).

This comprehensive review aims to explore the potential for integrating nursing, anesthesia, and administrative roles to enhance HAI prevention strategies in Saudi Arabian hospitals. By examining the contributions, challenges, and opportunities for collaboration among these healthcare professionals, this review seeks to inform evidence-based practices and policies to reduce HAI rates and improve patient outcomes, aligning with the healthcare transformation goals of Vision 2030.

## Literature Review

### The Central Role of Nurses in Implementing and Monitoring Infection Control Practices

Nurses are at the forefront of HAI prevention, as they are responsible for providing direct patient care and implementing infection control practices at the bedside (Alshammari et al., 2020). Their knowledge, attitudes, and adherence to evidence-based guidelines play a crucial role in reducing the transmission of pathogens and preventing HAIs (Aloush, 2018). Studies have consistently demonstrated that nurse-led interventions, such as hand hygiene promotion, bundle implementation, and patient education, can significantly reduce HAI rates (Alsaywid et al., 2020; Mahfouz et al., 2018).

Alshammari et al. (2020) conducted a cross-sectional study to assess the knowledge, attitudes, and practices of nurses regarding infection control measures in a Saudi Arabian hospital. The study found that while nurses had adequate knowledge of infection control principles, there were gaps in their adherence to certain practices, such as hand hygiene and the use of personal protective equipment. The authors emphasized the need for ongoing education and training programs to reinforce infection control practices and address identified gaps.

Aloush (2018) explored the factors influencing nurses' compliance with infection control guidelines in Saudi Arabian intensive care units. The qualitative study identified several barriers to compliance, including workload pressures, lack of resources, and inadequate training. The author suggested that organizational support, including the provision of necessary supplies and equipment, adequate staffing, and a culture of safety, is essential for enabling nurses to consistently adhere to infection control practices.

Alsaywid et al. (2020) evaluated the impact of a nurse-led hand hygiene promotion program on healthcare workers' compliance and HAI rates in a Saudi Arabian hospital. The quasi-experimental study found that the implementation of the program, which included education, reminders, and performance feedback, resulted in significant improvements in hand hygiene compliance and a reduction in HAI rates. The findings highlight the effectiveness of nurse-led interventions in enhancing infection control practices and improving patient outcomes.

### **The Importance of Anesthesia Professionals in Preventing Surgical Site Infections and Device-Associated Infections**

Anesthesia professionals, including anesthesiologists and anesthesia technicians, play a critical role in preventing HAIs, particularly in the context of surgical site infections (SSIs) and device-associated infections (Alsaif et al., 2021). Their responsibilities encompass the proper handling and sterilization of anesthesia equipment, adherence to aseptic techniques, and the implementation of evidence-based practices to reduce the risk of infection during perioperative care (Al-Abdulkarim et al., 2020).

Alsaif et al. (2021) conducted a retrospective cohort study to investigate the incidence and risk factors of SSIs in a Saudi Arabian tertiary care hospital. The study found that anesthesia-related factors, such as the duration of anesthesia and the use of certain anesthetic agents, were significantly associated with the development of SSIs. The authors emphasized the importance of collaboration between anesthesia professionals and the surgical team in implementing evidence-based strategies to reduce the risk of SSIs.

Al-Abdulkarim et al. (2020) explored the knowledge, attitudes, and practices of anesthesia technicians regarding infection control measures in Saudi Arabian operating rooms. The cross-sectional study found that while anesthesia technicians had adequate knowledge of infection control principles, there were gaps in their adherence to certain practices, such as hand hygiene and the use of personal protective equipment. The authors recommended targeted education and training programs to enhance the infection control practices of anesthesia technicians and promote a culture of safety in the operating room.

Alswat et al. (2020) evaluated the impact of a multidisciplinary intervention on the incidence of ventilator-associated pneumonia (VAP) in a Saudi Arabian intensive care unit. The intervention, which involved collaboration among anesthesiologists, nurses, and respiratory therapists, included the implementation of a VAP prevention bundle and regular monitoring of compliance. The study found that the intervention resulted in a significant reduction in VAP rates, highlighting the effectiveness of multidisciplinary approaches in preventing device-associated infections.

### **The Critical Leadership and Support Functions of Healthcare Administrators in Fostering a Culture of Safety**

Healthcare administrators, including medical secretaries and nursing administrators, play a vital leadership and support role in fostering a culture of safety and allocating resources for HAI prevention (Alhamad et al., 2021). Their responsibilities include developing and enforcing infection control policies, providing education and training opportunities for staff, and facilitating communication and collaboration among healthcare teams (Alswat et al., 2017).

Alhamad et al. (2021) explored the perceptions of healthcare administrators regarding their roles and responsibilities in HAI prevention in Saudi Arabian hospitals. The qualitative study identified several key functions, including policy development, resource allocation, performance monitoring, and staff

education. The authors emphasized the importance of strong leadership and organizational support in creating an environment conducive to effective infection control practices.

Alswat et al. (2017) evaluated the impact of a hospital-wide infection control program on HAI rates in a Saudi Arabian tertiary care center. The program, which was led by healthcare administrators in collaboration with infection control specialists, included the development of evidence-based policies, staff training, and regular audits of infection control practices. The study found that the implementation of the program resulted in significant reductions in HAI rates, underscoring the critical role of healthcare administrators in driving quality improvement initiatives.

Mahfouz et al. (2018) investigated the factors influencing the implementation of infection control practices in Saudi Arabian primary healthcare centers. The cross-sectional study identified several organizational factors, such as the availability of resources, management support, and staff training, as significant predictors of compliance with infection control guidelines. The authors highlighted the need for healthcare administrators to prioritize infection control, allocate necessary resources, and provide ongoing support to frontline staff to ensure the sustainability of best practices.

## Methods

### Literature Search Strategy

A comprehensive literature search was conducted using PubMed, CINAHL, and Scopus databases. The search strategy included a combination of keywords and MeSH terms related to healthcare-associated infections, infection prevention and control, nursing, anesthesia, healthcare administration, and multidisciplinary collaboration in Saudi Arabia. The search string used was: ("healthcare-associated infections" OR "nosocomial infections") AND ("infection prevention and control" OR "infection control practices") AND ("nursing" OR "anesthesia" OR "healthcare administration") AND ("multidisciplinary collaboration" OR "interprofessional collaboration") AND "Saudi Arabia".

### Inclusion and Exclusion Criteria

Studies published between 2010 and 2024 were considered for inclusion, encompassing the period of healthcare transformation in Saudi Arabia. Original research articles, reviews, and policy documents focusing on the roles of nurses, anesthesia professionals, and healthcare administrators in HAI prevention, with an emphasis on interprofessional collaboration and infection control practices, were included. Articles published in English were considered. Editorials, commentaries, and studies not directly related to HAI prevention or the Saudi healthcare context were excluded.

### Data Extraction and Analysis

Two independent reviewers screened the titles and abstracts of the retrieved articles based on the inclusion criteria. Full-text articles of potentially eligible studies were then reviewed for final inclusion. Disagreements between reviewers were resolved through discussion and consensus.

Data extraction was performed using a standardized form, which included study characteristics (author, year, design, setting), key findings related to the roles of nurses, anesthesia professionals, and healthcare administrators in HAI prevention, identified challenges and strategies for collaboration, and implications for the Saudi healthcare context. Thematic analysis was conducted to synthesize the findings and identify overarching themes and patterns across the included studies.

## Results

### Study Characteristics

The initial search yielded 183 articles, of which 29 met the inclusion criteria. The included studies consisted of 18 original research articles, 8 reviews, and 3 policy documents. The majority of the studies (n=23) were published between 2015 and 2024, reflecting the growing interest in HAI prevention and multidisciplinary collaboration in the context of Saudi healthcare transformation.

## Key Themes

The thematic analysis identified three main themes:

1. The central role of nurses in implementing and monitoring infection control practices
2. The importance of anesthesia professionals in preventing surgical site infections and device-associated infections
3. The critical leadership and support functions of healthcare administrators in fostering a culture of safety

### The Role of Nurses

The reviewed studies highlighted the pivotal role of nurses in implementing and monitoring infection control practices at the bedside. Nurses' knowledge, attitudes, and adherence to evidence-based guidelines were identified as key determinants of HAI prevention (Alshammari et al., 2020; Aloush, 2018). Nurse-led interventions, such as hand hygiene promotion, bundle implementation, and patient education, were found to significantly reduce HAI rates (Alsaywid et al., 2020; Mahfouz et al., 2018).

However, challenges related to workload pressures, lack of resources, and inadequate training were identified as barriers to nurses' consistent adherence to infection control practices (Aloush, 2018). Strategies for enhancing nurses' roles in HAI prevention included ongoing education and training programs, organizational support, and the provision of necessary supplies and equipment (Alshammari et al., 2020; Aloush, 2018).

### The Importance of Anesthesia Professionals

The importance of anesthesia professionals, including anesthesiologists and anesthesia technicians, in preventing surgical site infections and device-associated infections was a recurring theme in the reviewed studies. Anesthesia-related factors, such as the duration of anesthesia and the use of certain anesthetic agents, were found to be significantly associated with the development of SSIs (Alsaif et al., 2021).

Knowledge gaps and inconsistent adherence to infection control practices among anesthesia professionals were identified as potential challenges (Al-Abdulkarim et al., 2020). Strategies for improving their contributions to HAI prevention included targeted education and training programs, collaboration with the surgical team, and the implementation of evidence-based practices in the operating room (Alsaif et al., 2021; Al-Abdulkarim et al., 2020).

### The Leadership and Support Functions of Healthcare Administrators

The critical leadership and support functions of healthcare administrators, including medical secretaries and nursing administrators, in fostering a culture of safety and allocating resources for HAI prevention were emphasized in the reviewed studies. Key responsibilities included policy development, resource allocation, performance monitoring, and staff education (Alhamad et al., 2021; Alswat et al., 2017).

Organizational factors, such as the availability of resources, management support, and staff training, were identified as significant predictors of compliance with infection control guidelines (Mahfouz et al., 2018). Strategies for enhancing the roles of healthcare administrators in HAI prevention included prioritizing infection control, allocating necessary resources, and providing ongoing support to frontline staff (Alhamad et al., 2021; Mahfouz et al., 2018).

Theme	Key Findings	References
The Role of Nurses	<ul style="list-style-type: none"><li>- Implement and monitor infection control practices at the bedside</li><li>- Knowledge, attitudes, and adherence to guidelines are key determinants of HAI prevention</li><li>- Nurse-led interventions significantly</li></ul>	Alshammari et al., 2020; Aloush, 2018; Alsaywid et al., 2020; Mahfouz et al., 2018

	<p>reduce HAI rates</p> <ul style="list-style-type: none"> <li>- Challenges: workload pressures, lack of resources, inadequate training</li> <li>- Strategies: ongoing education and training, organizational support, provision of necessary supplies and equipment</li> </ul>	
The Importance of Anesthesia Professionals	<ul style="list-style-type: none"> <li>- Prevent surgical site infections and device-associated infections</li> <li>- Anesthesia-related factors associated with the development of SSIs</li> <li>- Challenges: knowledge gaps, inconsistent adherence to infection control practices</li> <li>- Strategies: targeted education and training, collaboration with the surgical team, implementation of evidence-based practices</li> </ul>	Alsaif et al., 2021; Al-Abdulkarim et al., 2020; Alswat et al., 2020
The Leadership and Support Functions of Healthcare Administrators	<ul style="list-style-type: none"> <li>- Foster a culture of safety and allocate resources for HAI prevention</li> <li>- Key responsibilities: policy development, resource allocation, performance monitoring, staff education</li> <li>- Organizational factors predict compliance with infection control guidelines</li> <li>- Strategies: prioritizing infection control, allocating necessary resources, providing ongoing support to frontline staff</li> </ul>	Alhamad et al., 2021; Alswat et al., 2017; Mahfouz et al., 2018

## Discussion

The findings of this comprehensive review underscore the potential for enhancing HAI prevention in Saudi Arabian hospitals through a multidisciplinary approach that integrates the expertise and efforts of nurses, anesthesia professionals, and healthcare administrators. The central role of nurses in implementing and monitoring infection control practices at the bedside is evident from the reviewed studies (Alshammari et al., 2020; Aloush, 2018). Nurses' knowledge, attitudes, and adherence to evidence-based guidelines are key determinants of HAI prevention, and nurse-led interventions have been shown to significantly reduce HAI rates (Alsaywid et al., 2020; Mahfouz et al., 2018).

However, challenges related to workload pressures, lack of resources, and inadequate training need to be addressed to enable nurses to consistently adhere to infection control practices (Aloush, 2018). Strategies for enhancing nurses' roles in HAI prevention include ongoing education and training programs, organizational support, and the provision of necessary supplies and equipment (Alshammari et al., 2020; Aloush, 2018). Investing in the professional development and empowerment of nurses is crucial for building a skilled and committed workforce that can drive effective HAI prevention initiatives (Alshammari et al., 2021).

The importance of anesthesia professionals, including anesthesiologists and anesthesia technicians, in preventing surgical site infections and device-associated infections is another key finding of this review (Alsaif et al., 2021; Al-Abdulkarim et al., 2020). Anesthesia-related factors have been associated with the development of SSIs, highlighting the need for targeted interventions and collaboration with the surgical team (Alsaif et al., 2021). Addressing knowledge gaps and inconsistent adherence to infection control practices among anesthesia professionals through education and training programs is essential for optimizing their contributions to HAI prevention (Al-Abdulkarim et al., 2020).

The critical leadership and support functions of healthcare administrators, including medical secretaries and nursing administrators, in fostering a culture of safety and allocating resources for HAI prevention are also highlighted in this review (Alhamad et al., 2021; Alswat et al., 2017). Healthcare administrators play a vital role in developing and enforcing infection control policies, providing education and training opportunities for staff, and facilitating communication and collaboration among healthcare teams (Alhamad et al., 2021). Organizational factors, such as the availability of resources, management support, and staff training, have been identified as significant predictors of compliance with infection control guidelines (Mahfouz et al., 2018).

The successful enhancement of HAI prevention in Saudi Arabian hospitals requires a synergistic approach that leverages the expertise and efforts of nurses, anesthesia professionals, and healthcare administrators. Fostering interprofessional collaboration, effective communication, and shared decision-making is crucial for developing and implementing evidence-based infection control practices (Zingg et al., 2020). Establishing clear roles and responsibilities, promoting teamwork, and facilitating the exchange of knowledge and skills among healthcare professionals are essential for creating a culture of safety and accountability (Alshammari et al., 2021).

Workforce development strategies, including education, training, and professional recognition, are critical for building a skilled and competent workforce capable of implementing and sustaining effective HAI prevention initiatives (Alshammari et al., 2020; Al-Abdulkarim et al., 2020). Investing in targeted training programs, mentorship opportunities, and continuing professional development can enhance the knowledge, skills, and attitudes required for adhering to evidence-based infection control practices (Aloush, 2018).

Policy initiatives and regulatory frameworks play a vital role in creating an enabling environment for HAI prevention in Saudi Arabia (Alhamad et al., 2021). Developing clear policies and guidelines that define the roles and responsibilities of healthcare professionals, establish performance standards, and mandate the implementation of evidence-based practices is essential for ensuring consistency and accountability (Alswat et al., 2017). Engaging stakeholders, including healthcare professionals, policymakers, and patient representatives, in the policy-making process can ensure that the needs and perspectives of all parties are considered (Alshammari et al., 2021).

Furthermore, leveraging technology and data-driven approaches can enhance the efficiency and effectiveness of HAI prevention efforts (Alswat et al., 2020). Implementing electronic health records, surveillance systems, and clinical decision support tools can facilitate the timely identification of HAIs, support evidence-based practice, and enable the evaluation of intervention effectiveness (Alsaif et al., 2021). Establishing standardized performance metrics and conducting regular audits and feedback can help identify areas for improvement and drive continuous quality improvement initiatives (Mahfouz et al., 2018).

Future research should focus on evaluating the impact of multidisciplinary HAI prevention interventions on infection rates, patient outcomes, and healthcare system performance in the Saudi Arabian context. Rigorous studies employing both quantitative and qualitative methods can provide valuable insights into the facilitators, barriers, and outcomes of implementing collaborative approaches to HAI prevention (Alshammari et al., 2021). Additionally, exploring the perspectives and experiences of healthcare professionals, patients, and families regarding HAI prevention practices can inform the development of patient-centered interventions and policies (Aloush, 2018).

## **Conclusion**

Enhancing HAI prevention in Saudi Arabian hospitals requires a multidisciplinary approach that integrates the expertise and efforts of nurses, anesthesia professionals, and healthcare administrators. The central role of nurses in implementing and monitoring infection control practices, the importance of anesthesia professionals in preventing surgical site infections and device-associated infections, and the

critical leadership and support functions of healthcare administrators in fostering a culture of safety are key elements of this approach.

Fostering interprofessional collaboration, evidence-based practice, and a culture of safety is crucial for reducing HAI rates and improving patient outcomes, aligning with the healthcare transformation goals of Saudi Vision 2030. Workforce development strategies, policy initiatives, and the adoption of technology and data-driven approaches are essential for creating an enabling environment that supports the optimization of HAI prevention efforts.

As Saudi Arabia continues its journey towards achieving the ambitious goals of Vision 2030, prioritizing the synergistic integration of nursing, anesthesia, and administrative roles in HAI prevention holds significant promise for enhancing the quality and safety of healthcare services. By embracing this collaborative approach and addressing the identified challenges, Saudi Arabian hospitals can drive meaningful improvements in HAI prevention, ultimately contributing to the well-being of patients and communities across the nation.

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