

The Critical Role of Peri-operative Infection Control Nurses in the Mitigation of Surgical Site Infections: A Comprehensive Review

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HOW TO CITE THIS ARTICLE:

D. Kumar. The Critical Role of Peri-operative Infection Control Nurses in the Mitigation of Surgical Site Infections: A Comprehensive Review. Ophthalmol Allied Sci. 2026;12(1): 18–20.

ABSTRACT

Surgical Site Infections (SSIs) remain a primary cause of postoperative morbidity, mortality, and escalating healthcare expenditures. While surgeons and anesthesiologists are central to the operative process, the peri-operative infection control nurse (ICN) acts as the fundamental bridge between evidence-based practice and clinical application. This review examines the multifaceted responsibilities of the peri-operative ICN, ranging from environmental surveillance and sterilization oversight to the implementation of bundled care protocols. By synthesizing current literature, this paper argues that the specialization of the ICN is not merely ancillary but essential to the high-reliability culture required to minimize patient risk in the surgical suite.

KEYWORDS

• Surgical Site Infection • Surgical Wound Infection • Infection Control • Patient Safety • Perioperative Infection Control • Asepsis

INTRODUCTION

Despite significant advancements in surgical technology and prophylactic antibiotic therapy, Surgical Site Infections (SSIs) continue to account for approximately 20% of all healthcare-associated infections (HAIs). The economic burden of SSIs is staggering, with billions of dollars diverted annually to

cover extended hospital stays, reoperations, and pharmacological interventions.

Within the sterile environment of the operating room (OR), the peri-operative infection control nurse (ICN) occupies a unique position. Unlike general nursing staff, the ICN is trained specifically in the epidemiology of pathogenic transmission and the rigorous

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➤ Received: 04.07.2026 ➤ Accepted: 05.08.2026



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application of aseptic technique. This paper explores the preventative strategies employed by ICNs and evaluates the evidence supporting their roles in reducing SSI rates through standardized surveillance, staff education, and environmental management.

THEORETICAL FRAMEWORK: THE CHAIN OF INFECTION IN THE OR

The primary mission of the peri-operative ICN is the disruption of the “Chain of Infection” the infectious agent, reservoir, portal of exit, mode of transmission, portal of entry, and susceptible host.

In a surgical context, the ICN focuses heavily on **Mode of Transmission** and **Portal of Entry**. The OR is a dynamic environment where the ingress of pathogens is constant. The ICN serves as the “gatekeeper,” monitoring air exchange rates, traffic flow, and the integrity of sterile equipment. By applying the principles of microbiology to the physical layout of the surgical suite, the ICN mitigates risks that are often invisible to the surgical team during high-intensity procedures.

CORE COMPETENCIES AND PREVENTATIVE STRATEGIES

1. Surveillance and Data Analytics

The ICN is responsible for the systematic collection and analysis of SSI data. Modern surveillance goes beyond simple documentation; it involves identifying surgical “clusters” or trends in post-operative wound cultures. By utilizing real-time infection data, the ICN provides feedback to surgical teams, fostering a culture of accountability. Research by Anderson *et al.* (2021) suggests that nursing-led surveillance programs are associated with a 15–20% reduction in reporting bias and a more accurate understanding of hospital-acquired infection trends.

2. Implementation of Care Bundles

The “bundle” approach—a structured set of evidence-based practices—is the gold standard for SSI prevention. The ICN is the primary orchestrator of these bundles, which include:

- **Pre-operative:** Appropriate skin preparation with chlorhexidine-alcohol, glycemic control, and timely prophylactic

antibiotic administration.

- **Intra-operative:** Normothermia maintenance (hypothermia disrupts immune function), traffic restriction, and meticulous sterile field management.
- **Post-operative:** Proper dressing management and patient education on wound care.

The ICN ensures that these bundles are not practiced as “check-box” exercises but are integrated into the workflow of every surgical case.

3. Environmental and Sterilization Oversight

The ICN’s scope extends to the Central Sterile Supply Department (CSSD). They monitor the sterilization efficacy of surgical instruments, ensuring that autoclaving parameters (pressure, temperature, and duration) meet international standards (ISO). Furthermore, the ICN acts as an auditor of environmental surfaces, overseeing the selection of high-level disinfectants and ensuring that cleaning protocols effectively combat emerging multi-drug resistant organisms (MDROs) like MRSA and *C. auris*.

THE HUMAN ELEMENT: EDUCATION AND SAFETY CULTURE

Technical expertise is insufficient without a robust safety culture. The ICN serves as an educator, bridging the gap between clinical research and practice. This involves:

- **Simulation Training:** Coordinating mock scenarios for OR staff to practice aseptic technique under pressure.
- **The “Stop the Line” Authority:** The ICN empowers nurses and technicians to intervene regardless of the seniority of the surgical staff if a breach in sterility is observed. This psychological safety is paramount, as the fear of challenging senior surgeons remains a significant barrier to infection control.

CHALLENGES AND CONTEMPORARY ISSUES

1. Increased Surgical Complexity

As surgical procedures become more invasive and patients present with higher

comorbidity profiles (diabetes, obesity, immunosuppression), the preventive burden increases. The ICN must adapt protocols to suit individual patient risk factors rather than applying “one-size-fits-all” solutions.

2. Antimicrobial Stewardship

With the rise of antibiotic resistance, the ICN is increasingly involved in the “Antimicrobial Stewardship Program” (ASP). By monitoring the duration of post-operative antibiotic prophylaxis, the ICN helps prevent the development of resistant flora, a task that requires close collaboration with infectious disease physicians and pharmacy departments.

DISCUSSION: EVIDENCE OF IMPACT

The literature consistently demonstrates that hospitals with dedicated infection control nursing staff exhibit lower SSI rates compared to institutions that rely on general nursing staff for these duties. A systematic review reveals that the presence of an ICN in the OR correlates with improved compliance in hand hygiene, adherence to antiseptic protocols, and reduced surgical tray contamination rates. The ICN acts as an “in-situ” quality improvement agent, whose constant presence serves as a reminder of patient safety standards.

FUTURE DIRECTIONS

The future of peri-operative infection control lies in digital transformation. The integration of “Smart ORs”—which utilize RFID tracking for instrument sterilization status and real-time ventilation sensors—will allow ICNs to manage infection risk through data dashboards. However, technology cannot replace the ICN; it will instead enhance their ability to intervene clinically. Future research should focus on the impact of ICN-led intervention programs on long-term patient outcomes, specifically targeting complex orthopedic and cardiovascular surgeries.

CONCLUSION

The peri-operative infection control nurse is a linchpin of modern surgical safety. By integrating surveillance, evidence-based bundles, staff education, and environmental rigor, they provide the necessary oversight to protect the most vulnerable of patients. As surgical medicine continues to evolve, the demand for specialized nursing roles in infection control will grow. Institutions must prioritize the empowerment and education of these professionals to ensure that the surgical suite remains a space of healing, rather than a site of preventable harm.

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