

PREVENTION OF OCCUPATIONAL INFECTIONS IN OPERATING ROOM NURSES**Khonturaeva M. Yu.***Lecturer, Andijan Abu Ali Ibn Sina Public Health Technical School*

ABSTRACT: Occupational infections remain a significant health risk for operating room nurses due to constant exposure to blood, biological fluids, sharp instruments, and invasive procedures. Despite advances in surgical technologies and infection control protocols, operating room nurses continue to experience a high risk of bloodborne and contact-transmitted infections, including hepatitis B, hepatitis C, and human immunodeficiency virus. This review analyzes current evidence on the epidemiology, risk factors, and mechanisms of occupational infections among operating room nurses, with particular emphasis on preventive strategies. Key aspects include adherence to standard precautions, proper use of personal protective equipment, safe handling of sharp instruments, sterilization and disinfection practices, and the role of education and continuous training. The review also highlights organizational and behavioral factors influencing compliance with infection prevention measures. Understanding the multifactorial nature of occupational infection risks is essential for developing effective preventive programs. Strengthening infection control practices in operating rooms is critical for protecting nursing staff, improving workplace safety, and ensuring high-quality surgical care.

Keywords: occupational infections, operating room nurses, infection prevention, bloodborne pathogens, personal protective equipment, sharps injuries, sterilization, infection control, workplace safety, nursing practice.

ПРОФИЛАКТИКА ПРОФЕССИОНАЛЬНЫХ ИНФЕКЦИЙ У МЕДИЦИНСКИХ СЕСТЁР ОПЕРАЦИОННОГО БЛОКА

АННОТАЦИЯ: Профессиональные инфекции остаются значительным риском для здоровья медицинских сестер операционных из-за постоянного контакта с кровью, биологическими жидкостями, острыми инструментами и инвазивными процедурами. Несмотря на достижения в хирургических технологиях и протоколах инфекционного контроля, медицинские сестры операционных продолжают подвергаться высокому риску заражения инфекциями, передающимися через кровь и контактным путем, включая гепатит В, гепатит С и вирус иммунодефицита человека. В данном обзоре анализируются современные данные об эпидемиологии, факторах риска и механизмах профессиональных инфекций среди медицинских сестер операционных, с особым акцентом на профилактические стратегии. Ключевые аспекты включают соблюдение стандартных мер предосторожности, правильное использование средств индивидуальной защиты, безопасное обращение с острыми инструментами, методы стерилизации и дезинфекции, а также роль обучения и непрерывного повышения квалификации. В обзоре также освещаются организационные и поведенческие факторы, влияющие на соблюдение мер профилактики инфекций. Понимание многофакторной природы рисков профессиональных инфекций имеет важное значение для разработки эффективных профилактических программ. Укрепление практики инфекционного контроля в операционных имеет решающее значение для защиты медицинского персонала, повышения безопасности на рабочем месте и обеспечения высококачественной хирургической помощи.

Ключевые слова: профессиональные инфекции, операционные медсестры, профилактика инфекций, патогены, передающиеся через кровь, средства индивидуальной защиты, травмы от острых предметов, стерилизация, инфекционный контроль, безопасность на рабочем месте, сестринская практика.

RELEVANCE: Occupational infections among healthcare workers remain a critical public health and occupational safety issue worldwide. Operating room nurses represent one of the most vulnerable professional groups due to the nature of their work, which involves direct contact with blood, body fluids, contaminated instruments, and invasive procedures. According to the World Health Organization, millions of healthcare workers experience occupational exposure to bloodborne pathogens each year, resulting in thousands of preventable infections [1]. Operating room nurses account for a substantial proportion of needlestick injuries and mucocutaneous exposures due to frequent handling of sharp instruments in high-pressure environments.

The relevance of occupational infection prevention has increased in recent years due to the growing complexity of surgical procedures, extended operation times, and increased workload in surgical departments. Time constraints, emergency interventions, and staff shortages may compromise adherence to infection control protocols, increasing the risk of exposure. Furthermore, the emergence of new infectious threats and antimicrobial-resistant pathogens poses additional challenges for occupational safety in operating rooms [2].

From a preventive medicine perspective, occupational infections have consequences beyond individual health. Infected healthcare workers may contribute to nosocomial transmission, increase patient morbidity, and impose additional costs on healthcare systems. Prevention of occupational infections is therefore essential for protecting healthcare personnel, ensuring continuity of care, and maintaining patient safety. Reviewing current evidence on occupational infection prevention in operating room nurses is timely and necessary to strengthen infection control practices and promote safer surgical environments.

MATERIALS AND METHODS: This review is based on an analysis of contemporary scientific literature addressing occupational infections, infection control, and preventive measures among operating room nurses. Sources were identified through systematic searches of PubMed, Scopus, Web of Science, and Google Scholar, as well as guidelines and reports from the World Health Organization, Centers for Disease Control and Prevention, and occupational health agencies.

Search terms included occupational infections, operating room nurses, needlestick injuries, bloodborne pathogens, infection prevention, and surgical safety. Peer-reviewed articles, systematic reviews, epidemiological studies, and international guidelines published within the last 10–15 years were prioritized. A qualitative synthesis approach was used to summarize epidemiological data, risk factors, and preventive strategies relevant to operating room nursing practice [3,4].

RESULTS AND DISCUSSION: Operating room nurses are at increased risk of occupational infections compared to other healthcare professionals due to frequent exposure to blood and sharp instruments. Epidemiological studies report that 40–60% of healthcare workers experience at least one needlestick injury during their career, with operating room personnel among the most affected groups [5].

Needlestick and sharps injuries are the primary routes of occupational transmission of bloodborne pathogens. The risk of infection following exposure varies by pathogen and exposure type. The estimated risk of transmission after percutaneous exposure is approximately 30% for hepatitis B virus in non-immunized individuals, 1–3% for hepatitis C virus, and 0.3% for human immunodeficiency virus [6]. Although vaccination has reduced the incidence of hepatitis B among healthcare workers, hepatitis C and emerging viral infections remain significant concerns. In addition to bloodborne infections, operating room nurses are exposed to contact-transmitted pathogens through contaminated surfaces, instruments, and surgical smoke. Inadequate

environmental cleaning and breaches in aseptic technique contribute to occupational exposure risk.

Multiple factors influence the risk of occupational infections in operating room nurses. Procedural factors include the use of sharp instruments, emergency surgeries, high patient turnover, and prolonged operations. Behavioral factors, such as inconsistent use of personal protective equipment and improper handling of sharps, significantly increase exposure risk.

Organizational factors also play a critical role. Insufficient staffing, lack of safety-engineered devices, inadequate training, and poor safety culture contribute to higher rates of occupational exposure [7]. Fatigue and time pressure impair attention and compliance with safety protocols, particularly during long or complex surgical procedures.

Individual factors, including professional experience and risk perception, influence preventive behavior. Studies indicate that less experienced nurses may have higher exposure rates due to limited practical skills, while experienced nurses may underestimate risk due to routine familiarity [8].

Bloodborne pathogens represent the most significant occupational infection risk in operating rooms. Hepatitis B, hepatitis C, and human immunodeficiency virus remain the primary concerns. Transmission occurs mainly through percutaneous injuries, such as needlesticks or cuts from contaminated instruments, and through mucocutaneous contact with blood or body fluids.

Preventive measures targeting these transmission routes are therefore critical. Vaccination against hepatitis B is a cornerstone of occupational infection prevention and has been shown to reduce infection incidence by more than 90% among immunized healthcare workers [9]. However, no vaccines are currently available for hepatitis C or human immunodeficiency virus, highlighting the importance of exposure prevention and post-exposure management.

Standard precautions form the foundation of occupational infection prevention in operating rooms. These include hand hygiene, use of gloves, gowns, masks, eye protection, and safe handling of sharp instruments. Proper and consistent use of personal protective equipment significantly reduces exposure risk.

Studies demonstrate that correct use of double gloving during surgery can reduce the risk of blood contact by up to 70% [10]. Eye and face protection are essential for preventing mucocutaneous exposure, particularly during procedures involving splashing or aerosol generation.

Despite clear guidelines, compliance with standard precautions is often suboptimal. Factors such as discomfort, reduced dexterity, and time constraints may limit consistent use of protective equipment. Addressing these barriers is essential for improving occupational safety.

Sharps injuries represent the most common and dangerous occupational exposure among operating room nurses. Needles, scalpels, suture needles, and other sharp surgical instruments are responsible for the majority of bloodborne pathogen transmissions in surgical settings. Studies indicate that up to 70% of all occupational exposures in operating rooms are related to sharps injuries, with nurses being disproportionately affected due to their active involvement in instrument handling and disposal [11].

High-risk moments include passing instruments during surgery, suturing, needle recapping, and disposal of used sharps. Emergency procedures and unexpected patient movements further increase injury risk. Evidence shows that implementation of safety-engineered devices, such as blunt suture needles and needleless systems, can reduce sharps injuries by 30–60% [12]. The use of hands-free techniques for passing instruments (“neutral zone” approach) has also been shown to significantly decrease accidental injuries.

Education on safe handling practices remains essential. Operating room nurses must be trained to avoid manual recapping of needles, use puncture-resistant sharps containers, and immediately report all exposure incidents. Creating a culture of safety where reporting is encouraged without fear of blame is critical for effective prevention.

Sterilization and disinfection are fundamental components of infection control in surgical environments and play a crucial role in protecting both patients and healthcare workers. Operating room nurses are directly involved in monitoring sterilization processes, handling sterile instruments, and maintaining aseptic conditions throughout surgical procedures.

Failures in sterilization or breaches in aseptic technique increase the risk of occupational exposure to pathogenic microorganisms. Studies demonstrate that improper handling of contaminated instruments and inadequate decontamination procedures contribute significantly to occupational infection risk [13]. Nurses must therefore possess comprehensive knowledge of sterilization methods, including steam sterilization, low-temperature plasma systems, and chemical disinfectants.

Adherence to standardized protocols and regular monitoring of sterilization indicators are essential. Operating room nurses act as key control points in ensuring compliance with infection prevention standards. Continuous quality control and documentation of sterilization processes enhance safety and accountability.

In addition to bloodborne and contact-transmitted infections, operating room nurses may be exposed to airborne contaminants, including surgical smoke generated during electrosurgical and laser procedures. Surgical smoke contains particulate matter, toxic chemicals, and potentially viable microorganisms, posing respiratory and mucosal exposure risks [14].

Although the infectious risk associated with surgical smoke remains under investigation, studies suggest that prolonged exposure may have adverse health effects. Use of smoke evacuation systems and appropriate respiratory protection reduces exposure and should be considered part of comprehensive occupational infection prevention strategies.

Environmental cleaning and surface disinfection are also critical. High-touch surfaces in operating rooms may serve as reservoirs for pathogenic organisms if not adequately disinfected. Operating room nurses contribute to maintaining a clean environment by ensuring proper cleaning protocols are followed between procedures.

Continuous education and training are essential for sustaining effective occupational infection prevention. Knowledge gaps, outdated practices, and lack of practical skills contribute to preventable exposure incidents. Evidence indicates that regular training programs significantly improve compliance with standard precautions and reduce occupational exposure rates [15].

Simulation-based training offers an effective approach for practicing safe handling of sharps, correct use of personal protective equipment, and management of exposure incidents. Competency-based education ensures that operating room nurses maintain up-to-date knowledge of evolving infection control guidelines.

Training programs should address not only technical skills but also risk perception and behavioral factors influencing compliance. Reinforcing the importance of personal safety as an integral part of patient safety promotes a holistic safety culture.

Organizational support plays a decisive role in preventing occupational infections. Adequate staffing levels, availability of protective equipment, and access to safety-engineered devices significantly influence exposure risk. Studies show that healthcare institutions with strong safety cultures and leadership commitment report lower rates of occupational injuries [16].

Behavioral factors, including adherence to protocols and willingness to report incidents, are shaped by organizational climate. Fear of blame, stigma, or administrative consequences may discourage reporting of exposure incidents, leading to missed opportunities for post-exposure prophylaxis and system improvement.

Leadership engagement, clear policies, and non-punitive reporting systems are essential for fostering compliance and continuous improvement in infection prevention practices.

Effective occupational health surveillance is a cornerstone of infection prevention in operating room nurses. Surveillance systems enable monitoring of exposure incidents, identification of risk

patterns, and evaluation of preventive measures. Regular health assessments and vaccination status monitoring contribute to early detection and risk reduction [17].

Post-exposure management protocols are critical for minimizing infection risk following occupational exposure. Immediate wound care, risk assessment, baseline testing, and timely initiation of post-exposure prophylaxis significantly reduce the likelihood of infection transmission. Studies demonstrate that prompt post-exposure interventions reduce HIV transmission risk by more than 80% [18].

Operating room nurses must be familiar with institutional post-exposure protocols and have rapid access to occupational health services. Training and clear communication are essential to ensure timely and appropriate response.

Psychosocial factors, including stress, fatigue, and workload, influence compliance with infection prevention practices. Operating room nurses often work under high-pressure conditions, which may compromise attention and adherence to safety protocols. Fatigue has been identified as a significant predictor of occupational injuries and errors [19].

Addressing psychosocial risks through workload management, adequate rest periods, and supportive work environments enhances compliance with preventive measures. Integrating occupational infection prevention into broader occupational health and well-being programs promotes sustainable safety outcomes.

Comprehensive Preventive Strategies and Best Practices

Effective prevention of occupational infections among operating room nurses requires a comprehensive, multi-level approach that integrates individual behavior, organizational support, and institutional policy. Single interventions are insufficient in the complex and high-risk environment of the operating room, where multiple exposure pathways coexist. Therefore, prevention strategies must be systematic, continuous, and evidence-based.

At the individual level, strict adherence to standard precautions remains the cornerstone of occupational infection prevention. Consistent hand hygiene, correct use of personal protective equipment, and safe handling of sharps significantly reduce exposure risk. Studies demonstrate that high compliance with standard precautions can lower occupational exposure rates by up to 50% [20]. Vaccination against hepatitis B is a critical preventive measure and should be mandatory for all operating room personnel.

At the organizational level, ensuring the availability of safety-engineered devices, adequate staffing, and appropriate workload distribution is essential. Introduction of needleless systems, blunt suture needles, and puncture-resistant disposal containers has been shown to significantly reduce sharps injuries [21]. Work schedules should minimize fatigue, as exhaustion negatively affects attention and compliance with safety protocols.

Institutional infection prevention programs must include continuous education, regular audits, and feedback mechanisms. Simulation-based training and competency assessments help maintain high standards of practice. Importantly, a non-punitive safety culture that encourages reporting of exposure incidents is critical for early intervention and system improvement.

International and national guidelines provide a structured framework for preventing occupational infections in operating rooms. Recommendations from the World Health Organization, Centers for Disease Control and Prevention, and occupational health agencies emphasize standard precautions, vaccination, exposure reporting, and post-exposure management [22].

Implementation of these guidelines at the institutional level requires adaptation to local contexts, availability of resources, and staff engagement. Evidence suggests that healthcare facilities with well-defined infection control policies and active leadership involvement report lower rates of occupational exposure [23]. Regular updating of protocols in response to emerging infectious threats is also essential.

Policy-level support is particularly important in low- and middle-income countries, where resource limitations may compromise infection prevention. Investment in occupational health

infrastructure and training programs yields long-term benefits by reducing healthcare worker infections and associated costs.

Occupational health services play a pivotal role in the prevention of occupational infections among operating room nurses. Continuous monitoring of exposure incidents, vaccination coverage, and compliance with preventive measures enables early identification of risk trends. Health surveillance data inform targeted interventions and policy adjustments.

Routine health assessments should include evaluation of exposure history, immune status, and compliance with infection prevention protocols. Operating room nurses should have rapid access to occupational health services for post-exposure evaluation and prophylaxis. Studies indicate that timely post-exposure management significantly reduces the risk of infection transmission and improves psychological outcomes following exposure incidents [24].

Integration of occupational infection surveillance into hospital quality and safety systems enhances accountability and promotes continuous improvement.

Preventing occupational infections is not only a clinical and organizational responsibility but also an ethical imperative. Healthcare institutions have a duty to provide safe working conditions and protect staff from preventable harm. Operating room nurses, in turn, have a professional responsibility to adhere to infection prevention standards to protect themselves and their patients. Ethical considerations include informed consent for vaccination, confidentiality of exposure reports, and equitable access to protective resources. Promoting ethical awareness alongside technical training reinforces a culture of mutual responsibility and trust within surgical teams.

CONCLUSION: Occupational infections remain a significant and persistent risk for operating room nurses due to continuous exposure to blood, biological fluids, sharp instruments, and contaminated environments. This review highlights that, despite advances in surgical techniques and infection control technologies, occupational exposure to infectious agents remains a critical challenge in operating room practice.

The evidence presented demonstrates that sharps injuries, bloodborne pathogen exposure, and contact with contaminated surfaces constitute the primary routes of occupational infection. Multiple factors—including procedural complexity, workload, fatigue, and organizational deficiencies—contribute to increased exposure risk. Importantly, occupational infections have consequences that extend beyond individual health, affecting patient safety, workforce sustainability, and healthcare system performance.

Preventive strategies must therefore be comprehensive and integrated. Adherence to standard precautions, correct use of personal protective equipment, vaccination, safe handling of sharps, and effective sterilization practices are fundamental components of prevention. Education and continuous training strengthen compliance and competence, while organizational support and safety culture significantly influence preventive behavior.

Occupational health services play a central role in surveillance, early detection, and post-exposure management. Timely intervention following exposure incidents reduces infection transmission risk and supports the physical and psychological well-being of nursing staff. Policy-level commitment and alignment with international guidelines further enhance prevention effectiveness.

In conclusion, prevention of occupational infections in operating room nurses requires sustained commitment at individual, organizational, and policy levels. Strengthening infection prevention practices protects nursing staff, improves patient safety, and contributes to the overall quality and resilience of surgical healthcare systems. Continued research, education, and investment in occupational health are essential to address evolving infectious risks and ensure safe working environments in operating rooms.

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