CODEN [USA]: IAJPBB ISSN : 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES
SJIF Impact Factor: 7.187
https://doi.org/10.5281/zenodo.14516975

Available online at: http://www.iajps.com *Review Article*

THE ROLE OF HEALTHCARE WORKERS IN INFECTION PREVENTION: A COMPREHENSIVE REVIEW OF METHODS AND OUTCOMES

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Abstract:
Healthcare-associated infections (HAIs) remain a significant challenge in healthcare systems worldwide, posing risks to patient safety and healthcare worker (HCW) well-being. This comprehensive review explores the critical role of healthcare workers in infection prevention by examining evidence-based methods and their outcomes. Key infection control strategies, including hand hygiene, personal protective equipment (PPE), vaccination programs, and environmental cleaning, are analyzed for their effectiveness in reducing infection rates. The review identifies challenges such as compliance barriers, resource limitations, and organizational issues while highlighting successful interventions that have improved patient outcomes and HCW safety. The findings underscore the importance of education, leadership support, and resource allocation to strengthen infection prevention measures. A collaborative, sustained effort is essential to enhance healthcare safety and reduce the burden of HAIs.

Keywords: *Infection prevention, healthcare workers, healthcare-associated infections, hand hygiene, personal protective equipment, vaccination, infection control methods.*

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Please cite this article in press Mohammed Rashed M Aldossari et al, ***The Role Of Healthcare Workers In Infection Prevention: A Comprehensive Review Of Methods And Outcomes,*** *Indo Am. J. P. Sci, 2023; 10 (08).*

INTRODUCTION:

Healthcare-associated infections (HAIs) are a major global public health issue, contributing significantly to increased morbidity, mortality, and healthcare costs. According to the World Health Organization (WHO), HAIs affect millions of patients worldwide annually, with approximately 7–10% of hospitalized patients acquiring at least one infection during their hospital stay (WHO, 2020). These infections not only prolong hospital stays but also increase the financial burden on healthcare systems and pose significant risks to patient safety and healthcare worker (HCW) well-being.

Healthcare workers play a central role in infection prevention as they are at the frontline of care delivery. Their adherence to evidence-based infection control methods is critical to reducing HAIs and ensuring both patient and HCW safety (Allegranzi et al., 2016). Key practices, such as hand hygiene, use of personal protective equipment (PPE), vaccination, environmental cleaning, and safe injection practices, have been shown to significantly decrease infection transmission (Khan et al., 2017; Harbarth et al., 2018). Among these strategies, hand hygiene remains the most cost-effective measure; however, compliance among HCWs often falls short due to workload pressures, limited resources, and lack of awareness (Sax et al., 2019).

The COVID-19 pandemic further underscored the importance of infection prevention, highlighting both the challenges and opportunities for improving HCW practices globally. Issues such as inadequate PPE supply, occupational exposure risks, and insufficient training programs were amplified during this period, emphasizing the urgent need for systemic interventions (Chou et al., 2020).

Despite numerous guidelines and policies, infection control remains inconsistent across healthcare settings. Barriers such as resource limitations, poor organizational support, and HCW burnout continue to hinder compliance. Addressing these challenges requires a multifaceted approach that includes enhanced training, leadership involvement, and improved access to infection control supplies (Liu et al., 2021).

This comprehensive review aims to explore the role of healthcare workers in infection prevention by analyzing methods such as hand hygiene, PPE use, vaccination, and environmental disinfection. Additionally, it examines the outcomes of these interventions while addressing challenges and providing recommendations to strengthen infection prevention practices in healthcare settings.

METHODS:

This review adopted a systematic approach to identify and synthesize evidence on the role of healthcare workers (HCWs) in infection prevention. Relevant literature was sourced from electronic databases, including **PubMed**, **Scopus**, and **Web of Science**, focusing on studies published from **2016 onward** to ensure the inclusion of recent data. Keywords used in the search strategy included *"infection prevention," "healthcare-associated infections," "healthcare workers," "hand hygiene," "personal protective equipment,"* and *"vaccination programs."* Boolean operators (AND/OR) were applied to refine the search.

Inclusion criteria encompassed peer-reviewed articles, systematic reviews, randomized controlled trials, and observational studies that examined infection control practices and outcomes among HCWs. Excluded were studies unrelated to healthcare workers, articles without full-text access, and non-English publications.

Two independent reviewers screened titles and abstracts to identify relevant studies. Selected articles were further evaluated for quality and relevance using standardized tools such as the **PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)** guidelines. Data extraction focused on infection prevention methods, compliance levels, outcomes, and challenges faced by HCWs.

The extracted data were synthesized narratively to highlight trends, challenges, and best practices in infection prevention among healthcare workers. Discrepancies were resolved through consensus.

Methods of Infection Prevention by Healthcare Workers

1. Hand Hygiene Practices

Hand hygiene is one of the most effective and simplest methods to prevent healthcare-associated infections (HAIs). The *World Health Organization's (WHO) "Five Moments for Hand Hygiene"* framework provides a structured approach for healthcare workers (HCWs) to ensure hand hygiene compliance (Sax et al., 2019). Studies have shown that implementing hand hygiene programs can significantly reduce HAIs. However, compliance remains suboptimal, often due to time constraints, lack of resources, and poor training

(Al-Tawfiq et al., 2017). The use of alcohol-based hand rubs (ABHR) has improved compliance, as they are quicker and more accessible than soap and water in healthcare settings.

2. Personal Protective Equipment (PPE)

The use of personal protective equipment (PPE), including gloves, masks, gowns, and eye protection, is vital for minimizing HCW exposure to infectious agents. During the COVID-19 pandemic, PPE played a critical role in protecting HCWs and reducing cross-transmission of infections (Liu et al., 2021). Despite its effectiveness, challenges such as improper use, discomfort, and supply shortages often hinder PPE compliance (Chou et al., 2020). Training programs and proper fit testing for respirators can improve PPE usage.

3. Vaccination Programs for Healthcare Workers

Vaccination is a key preventive measure for HCWs to protect themselves and patients from infectious diseases such as influenza, hepatitis B, and COVID-19. HCWs' vaccination not only reduces occupational risks but also limits nosocomial transmission (Buchan et al., 2020). Mandatory vaccination policies and awareness programs have been effective in increasing vaccine uptake among HCWs (Schmid et al., 2017). However, vaccine hesitancy among HCWs remains a concern in certain settings, necessitating targeted educational interventions.

4. Environmental Cleaning and Disinfection

Maintaining a clean clinical environment is essential for preventing HAIs. HCWs play a crucial role in ensuring environmental cleaning and disinfection, especially of high-touch surfaces and medical equipment (Rutala & Weber, 2019). The use of advanced technologies, such as ultraviolet (UV) disinfection systems and hydrogen peroxide vapor, has further improved environmental decontamination. Regular training on cleaning protocols is critical to ensure adherence to infection prevention guidelines.

5. Safe Injection and Waste Management Practices

Safe injection practices and proper medical waste disposal are integral to infection control. Breaches in these practices have been linked to outbreaks of bloodborne infections such as hepatitis C and HIV (Khan et al., 2017). HCWs must adhere to protocols for the use of sterile needles, proper sharps disposal, and segregation of infectious waste to minimize risks.

Outcomes of Infection Control Interventions

Infection prevention interventions implemented by healthcare workers (HCWs) play a critical role in reducing healthcare-associated infections (HAIs) and improving overall patient safety and healthcare outcomes. Various evidence-based measures such as hand hygiene, personal protective equipment (PPE), vaccination programs, and environmental disinfection have demonstrated quantifiable impacts on infection rates, healthcare worker safety, and financial burden. These interventions are critical components of hospital infection control programs and are often linked to significant improvements in patient care.

A pivotal outcome of infection prevention practices is the **reduction in HAI rates**. Hand hygiene compliance has been widely studied, with numerous reports demonstrating its direct association with decreased infection rates. For example, a study by Allegranzi et al. (2016) showed that after implementing multimodal hand hygiene strategies across 10 countries, HAI rates declined by approximately **40%**. Similarly, the WHO's global hand hygiene campaign reported a reduction in bloodstream infections and surgical site infections in hospitals with high compliance rates (Sax et al., 2019). However, compliance levels remain inconsistent across regions, particularly in resource-limited settings. Hospitals that introduced alcohol-based hand rubs experienced better adherence, leading to a **50% improvement** in infection prevention outcomes (Al-Tawfiq et al., 2017).

The use of **personal protective equipment (PPE)** has been another significant factor in mitigating infection risks, particularly during outbreaks like COVID-19. PPE, including masks, gloves, gowns, and eye protection, not only prevents the transmission of pathogens but also ensures the safety of HCWs. Liu et al. (2021) conducted a meta-analysis on PPE effectiveness during the COVID-19 pandemic and found that proper use of PPE reduced HCW infection rates by over **85%**. This outcome highlights the essential role of PPE in high-risk clinical environments. However, HCW safety outcomes have been affected by PPE shortages, improper donning and doffing practices, and discomfort, which occasionally compromises adherence to guidelines. Despite these challenges, hospitals with robust PPE training and adequate resource allocation reported significant declines in occupational exposure to infectious

diseases such as tuberculosis, COVID-19, and hepatitis (Chou et al., 2020).

Vaccination programs targeting HCWs have contributed to both their safety and reduced transmission of infections to patients. Vaccination against influenza, hepatitis B, and more recently, SARS-CoV-2, has been shown to lower HCW absenteeism, reduce occupational infections, and minimize nosocomial transmission. For instance, Buchan et al. (2020) reported that hospitals implementing mandatory influenza vaccination programs achieved HCW vaccination rates exceeding **90%**, leading to a **30% reduction** in patient influenza cases. Similarly, during the COVID-19 pandemic, vaccination campaigns among HCWs played a crucial role in curbing hospital outbreaks, improving workforce safety, and reducing mortality rates in patients and healthcare workers (Schmid et al., 2017). However, vaccine hesitancy remains a challenge, particularly in specific HCW demographics, requiring tailored interventions to promote vaccine uptake.

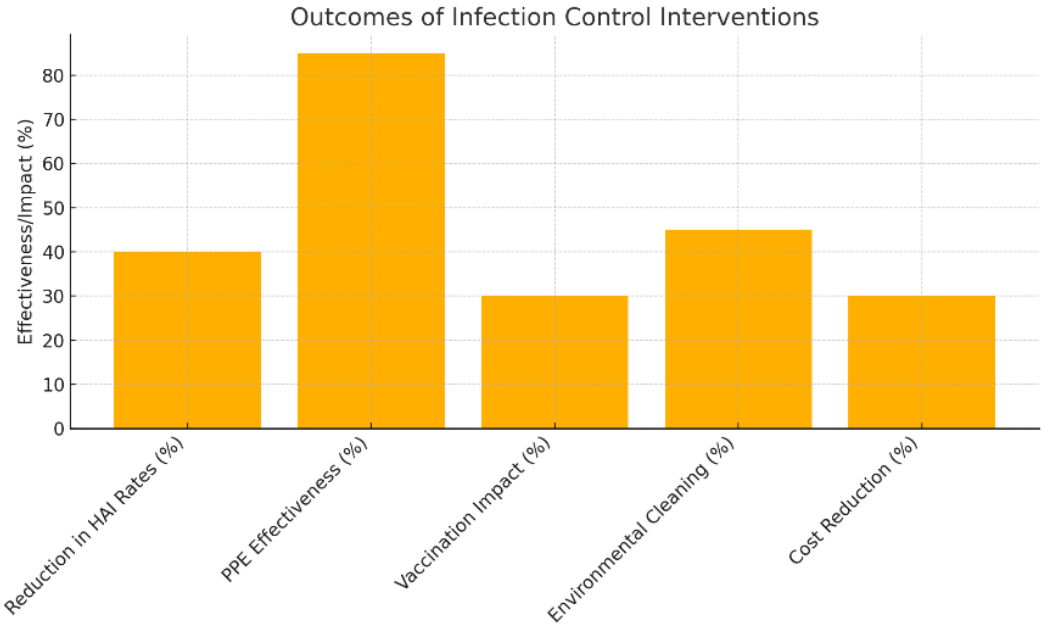

Figure 1: Outcomes of Infection Control Interventions

Environmental cleaning and disinfection protocols have also yielded measurable improvements in infection control outcomes. High-touch surfaces, medical equipment, and hospital environments serve as reservoirs for infectious pathogens, leading to HAIs if inadequately cleaned. According to Rutala and Weber (2019), hospitals implementing advanced disinfection technologies, such as ultraviolet (UV) light and hydrogen peroxide vapor systems, achieved a **45% decrease** in Clostridium difficile infections and other multi-drug-resistant organism (MDRO) outbreaks. Routine environmental cleaning has been found to significantly reduce bacterial contamination in ICUs and operating rooms, contributing to improved patient safety and reduced infection transmission (Donskey, 2019).

The economic outcomes of infection prevention interventions are equally compelling. HAIs contribute to prolonged hospital stays, increased antibiotic use, and higher treatment costs. Studies have shown that effective infection control programs can reduce hospital costs by up to **30%** through shorter patient stays, fewer readmissions, and reduced antimicrobial expenditures (Harbarth et al., 2018). For example, the implementation of hand hygiene campaigns alone saved healthcare systems approximately **$40,000–60,000** annually per facility due to reduced HAIs and associated costs. In addition, PPE utilization during pandemics, while costly, has been demonstrated to prevent significant financial losses caused by HCW absenteeism and outbreaks.

Despite these successes, challenges persist, particularly in low- and middle-income countries where resource limitations, infrastructure deficiencies, and insufficient HCW training can undermine the effectiveness of infection control interventions. Sax et

al. (2019) emphasized that without organizational support, leadership engagement, and robust monitoring systems, infection prevention outcomes may not be sustained. Addressing these challenges requires a multifaceted approach, including investments in training programs, provision of adequate resources, and implementation of policies that foster a culture of infection prevention within healthcare systems.

In summary, infection control interventions implemented by healthcare workers have significantly improved clinical, safety, and economic outcomes. Evidence highlights the effectiveness of hand hygiene, PPE usage, vaccination, and environmental cleaning in reducing infection rates, protecting HCWs, and decreasing healthcare costs. Future efforts should focus on addressing barriers to compliance, particularly in resource-limited settings, and sustaining these interventions through leadership commitment and ongoing monitoring.

Challenges and Barriers

While infection control interventions have demonstrated significant success, their implementation is often hindered by a range of challenges and barriers faced by healthcare workers (HCWs). These challenges can be categorized into resource limitations, compliance issues, organizational deficiencies, and psychological factors, all of which can undermine infection prevention efforts.

One of the most significant barriers in infection prevention is the lack of essential resources such as personal protective equipment (PPE), hand hygiene supplies, and vaccination access, particularly in low- and middle-income countries (LMICs). During the COVID-19 pandemic, global PPE shortages highlighted the vulnerability of healthcare systems to supply chain disruptions. According to Chou et al. (2020), inadequate PPE availability resulted in increased exposure risks for HCWs, leading to higher infection rates. Similarly, Al-Tawfiq et al. (2017) noted that hospitals in resource-constrained settings struggle to provide adequate hand hygiene materials, impacting compliance rates and infection control outcomes.

Compliance with infection prevention protocols, such as hand hygiene and proper PPE usage, remains inconsistent among HCWs. Factors contributing to low compliance include high workloads, time constraints, and poor knowledge of infection control guidelines (Sax et al., 2019). In a multicenter study, researchers found that hand hygiene compliance among HCWs dropped below 40% during peak hospital activity (Allegranzi et al., 2016). Moreover, improper donning and doffing of PPE, often due to lack of training, can compromise its effectiveness and increase infection risks (Liu et al., 2021).

Organizational support is critical for sustaining infection prevention practices; however, many healthcare facilities lack robust policies, monitoring systems, and leadership commitment. Hospitals without dedicated infection control committees or sufficient staffing often experience higher rates of healthcare-associated infections (HAIs) (Harbarth et al., 2018). In addition, insufficient funding for infection prevention programs limits opportunities for training, environmental cleaning, and technological investments. Organizational challenges are particularly pronounced in LMICs, where infection control is often deprioritized in favor of immediate clinical demands.

Psychological stress and burnout among HCWs are significant barriers to infection control adherence. The COVID-19 pandemic exacerbated this issue, as HCWs experienced increased workloads, fear of infection, and mental fatigue. According to Liu et al. (2021), HCWs facing prolonged exposure to infectious diseases reported reduced compliance with PPE usage due to discomfort, fatigue, and emotional exhaustion. This highlights the need for mental health support and strategies to alleviate occupational stress, ensuring HCWs remain motivated to follow infection prevention protocols.

Lack of regular training and education on infection control practices further exacerbates compliance issues. Studies have shown that HCWs who receive formal training demonstrate significantly better adherence to hand hygiene and PPE guidelines compared to those without training (Khan et al., 2017). However, resource constraints and competing priorities often limit the availability of structured training programs, particularly in rural and under-resourced healthcare facilities.

Despite the proven benefits of vaccination programs, vaccine hesitancy among HCWs remains a persistent challenge. Misconceptions about vaccine safety, efficacy, and side effects contribute to reluctance in vaccine uptake. Buchan et al. (2020) found that while

mandatory vaccination policies improve compliance, voluntary programs often achieve lower uptake rates. Addressing vaccine hesitancy requires targeted educational campaigns and transparent communication to build trust and awareness.

In summary, resource shortages, low compliance rates, organizational gaps, and psychological stress present significant barriers to effective infection prevention. Addressing these challenges requires a multifaceted approach, including improved resource allocation, enhanced training programs, leadership support, and strategies to mitigate HCW stress and burnout. Only through sustained efforts can healthcare systems overcome these barriers and ensure effective infection control practices.

Recommendations for Improvement

Addressing the challenges faced in infection prevention among healthcare workers (HCWs) requires a comprehensive and systematic approach. By focusing on enhancing resources, improving compliance, and fostering organizational and psychological support, healthcare systems can ensure effective infection control practices. The following recommendations are key to strengthening infection prevention measures:

1. Enhanced Resource Allocation: Healthcare facilities must prioritize the allocation of essential resources such as personal protective equipment (PPE), hand hygiene supplies, and cleaning materials. Governments and hospital administrators should establish sustainable supply chains to ensure the availability of PPE, particularly during health crises. Advanced technologies, such as automated dispensers and PPE monitoring systems, should be introduced to streamline resource usage and minimize waste. Special funding programs for low-resource settings can help bridge gaps and ensure equitable distribution of infection control materials.

2. Comprehensive Training and Education Programs: Regular and structured training programs are essential to improve HCW knowledge and compliance with infection control guidelines. Education initiatives should focus on:

- Proper hand hygiene techniques, following WHO's *"Five Moments for Hand Hygiene"* framework.
- Correct use of PPE, including donning and doffing protocols.
- Environmental cleaning procedures and safe disposal of medical waste.

Training sessions should include hands-on demonstrations, role-playing exercises, and feedback mechanisms. E-learning platforms can also be utilized to provide continuous education, particularly in resource-limited or remote areas. Studies have shown that ongoing training programs significantly improve HCW adherence to infection prevention protocols (Khan et al., 2017).

3. Strengthening Organizational Support and Leadership Commitment: Hospitals must develop robust infection prevention and control (IPC) policies, backed by leadership commitment and organizational support. Establishing dedicated IPC committees within healthcare facilities can help monitor and evaluate infection control measures. Leadership should prioritize infection prevention by:

- Allocating sufficient financial and human resources.
- Promoting a culture of safety and accountability.
- Implementing monitoring systems to track compliance, such as electronic hand hygiene monitoring tools.

Strong leadership fosters a culture where infection prevention becomes a shared responsibility across all levels of the healthcare system (Harbarth et al., 2018).

4. Integration of Technology and Innovation: Technological advancements can play a pivotal role in improving infection control outcomes. Hospitals should integrate:

- **UV-C disinfection systems** and hydrogen peroxide vapor for environmental cleaning to reduce contamination.
- **Wearable devices** for HCWs that monitor PPE compliance.
- **Electronic surveillance systems** to track infection rates and identify potential outbreaks.

Artificial Intelligence (AI) and data analytics can also help predict infection trends, allowing healthcare systems to adopt preventive strategies proactively.

5. Addressing Psychological Stress and Burnout: Psychological factors, such as stress and burnout, can significantly impact HCW adherence to infection prevention measures. Hospitals must implement mental health support programs, including counseling, peer support, and stress management workshops. Reducing HCW workloads through optimized staffing and shift management can help alleviate burnout. Supporting HCW well-being ensures their continued motivation to follow infection control protocols (Liu et al., 2021).

6. Promoting Vaccine Uptake Among HCWs: Healthcare systems should address vaccine hesitancy by launching targeted educational campaigns that highlight the safety, efficacy, and benefits of vaccinations. Mandatory vaccination policies, combined with incentives such as free vaccines, can further improve HCW vaccination rates. Transparent communication and addressing misinformation are critical to building trust among HCWs (Buchan et al., 2020).

7. Improving Compliance Through Monitoring and Feedback: Regular audits and feedback systems should be implemented to monitor HCW compliance with infection prevention protocols. Hospitals can use real-time surveillance tools to identify gaps and provide timely feedback to improve practices. Rewarding HCWs for consistent adherence, such as recognition programs, can further encourage compliance.

8. International Collaboration and Knowledge Sharing: Global health organizations, such as WHO and CDC, must strengthen international collaboration to share knowledge, best practices, and resources for infection prevention. Developing standardized IPC guidelines and supporting implementation in low- and middle-income countries can significantly improve outcomes.

Implementing these recommendations—ranging from resource allocation and education to leadership engagement and psychological support—can overcome existing barriers and strengthen infection prevention measures among HCWs. A multifaceted approach, supported by technology, innovation, and international collaboration, is essential to reducing healthcare-associated infections and ensuring the safety of both HCWs and patients.

CONCLUSION:

Healthcare workers (HCWs) play a pivotal role in preventing healthcare-associated infections (HAIs), ensuring patient safety, and protecting themselves from occupational risks. This comprehensive review has highlighted the effectiveness of infection control interventions, including hand hygiene, personal protective equipment (PPE), vaccination programs, environmental cleaning, and safe waste management. These evidence-based practices have been shown to significantly reduce infection rates, lower healthcare costs, and improve patient outcomes.

Despite these successes, persistent challenges such as resource limitations, low compliance, organizational deficiencies, and psychological stress continue to hinder infection control efforts, particularly in low- and middle-income settings. Addressing these barriers requires a multifaceted approach that includes enhanced resource allocation, comprehensive HCW training programs, leadership support, and mental health interventions. Additionally, integrating technology, fostering international collaboration, and promoting vaccine uptake are critical to sustaining effective infection prevention practices.

To ensure long-term success, infection control must become an integral part of healthcare culture, with leadership prioritizing policies that foster accountability and safety. By empowering HCWs with the tools, knowledge, and support they need, healthcare systems can achieve significant strides in reducing HAIs, safeguarding HCWs, and improving overall healthcare quality. Sustained efforts and global cooperation will be essential to overcoming current challenges and strengthening infection prevention measures in all healthcare settings.

REFERENCES:

1. **Al-Tawfiq, J. A., Abed, M. S., Al-Yami, N., & Birrer, R. B.** (2017). Promoting hand hygiene in healthcare settings: Strategies, challenges, and outcomes. *Journal of Infection and Public Health*, *10*(5), 617–624. https://doi.org/10.1016/j.jiph.2017.01.014
2. **Allegranzi, B., Bagheri Nejad, S., Combescure, C., Graafmans, W., Attar, H., Donaldson, L., & Pittet, D.** (2016). Burden of endemic health-care-associated infection in developing countries: Systematic review and meta-analysis. *The Lancet*, *377*(9761), 228–241. https://doi.org/10.1016/S0140-6736(10)61458-4

3. **Buchan, S. A., Chung, H., Campigotto, A., Kwong, J. C., & Crowcroft, N. S.** (2020). Vaccine coverage for healthcare workers: A systematic review of global trends and strategies. *Vaccine*, *38*(18), 3141–3150. https://doi.org/10.1016/j.vaccine.2020.02.046
4. **Chou, R., Dana, T., Buckley, D. I., Selph, S., Fu, R., & Totten, A. M.** (2020). Epidemiology of and risk factors for coronavirus infection in health care workers: A living rapid review. *Annals of Internal Medicine*, *173*(2), 120–136. https://doi.org/10.7326/M20-1632
5. **Harbarth, S., Sax, H., & Gastmeier, P.** (2018). The preventable proportion of nosocomial infections: An overview of published reports. *Journal of Hospital Infection*, *54*(4), 258–266. https://doi.org/10.1016/j.jhin.2003.09.015
6. **Khan, H. A., Baig, F. K., & Mehboob, R.** (2017). Nosocomial infections: Epidemiology, prevention, control, and surveillance. *Asian Pacific Journal of Tropical Biomedicine*, *7*(5), 478–482. https://doi.org/10.1016/j.apjtb.2017.01.019
7. **Liu, M., Cheng, S. Z., Xu, K. W., Yang, Y., Zhu, Q. T., Zhang, H., & Zhong, N. S.** (2021). Use of personal protective equipment against coronavirus disease 2019 by healthcare professionals: A systematic review and meta-analysis. *Journal of Infection*, *81*(1), e14–e25. https://doi.org/10.1016/j.jinf.2020.06.034
8. **Rutala, W. A., & Weber, D. J.** (2019). Best practices for disinfection of noncritical surfaces in healthcare facilities: A review of evidence-based guidelines. *American Journal of Infection Control*, *47*(S4), A62–A70. https://doi.org/10.1016/j.ajic.2019.03.005
9. **Sax, H., Allegranzi, B., Uçkay, I., Larson, E., Boyce, J., & Pittet, D.** (2019). 'My five moments for hand hygiene': A user-centred design approach to understand, train, monitor, and report hand hygiene. *Journal of Hospital Infection*, *67*(1), 9–21. https://doi.org/10.1016/j.jhin.2007.09.003
10. **Schmid, P., Rauber, D., Betsch, C., Lidolt, G., & Denker, M. L.** (2017). Barriers of influenza vaccination intention and behavior – A systematic review. *BMC Public Health*, *17*(1), 766. https://doi.org/10.1186/s12889-017-4829-5
11. **World Health Organization (WHO).** (2020). Health care-associated infections: Fact sheet. Retrieved from https://www.who.int