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Enhancing Awareness and Training on Infection Control Among Healthcare Workers to Reduce Healthcare-Associated Infections (HAIs)

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Abstract

Healthcare-associated infections (HAIs) remain a persistent and largely preventable threat to patient safety, health worker protection, and health-system sustainability. Because many HAIs are transmitted through routine care processes, healthcare workers (HCWs) are central to both risk and prevention. This paper examines the role of infection prevention and control (IPC) awareness and training in reducing HAIs in acute and long-term care settings. It reviews the burden and key drivers of HAIs, explains how knowledge, risk perception, and safety culture influence day-to-day IPC behaviors, and synthesizes evidence showing that education is most effective when embedded within multimodal improvement strategies (for example, system change, reminders, monitoring, and feedback). The paper also identifies common barriers to training implementation, including workload pressure, staff turnover, inconsistent supplies, and weak accountability structures. Finally, it proposes practical, evidence-informed approaches to strengthening IPC awareness and competency-based training, such as role-specific onboarding, simulation and bedside coaching, audit-and-feedback, leadership engagement, and integration of IPC competencies into quality

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governance. Overall, sustained IPC education is a cornerstone of HAI prevention and a high-value investment that improves patient outcomes, supports antimicrobial stewardship, and promotes workforce resilience.

Keywords: infection prevention and control; healthcare-associated infections; training; awareness; hand hygiene; personal protective equipment; patient safety; antimicrobial resistance

1. Introduction

Healthcare-associated infections (HAIs) are infections that patients acquire while receiving care in a healthcare facility and that were not present or incubating at the time of admission. HAIs include, among others, catheter-associated urinary tract infection (CAUTI), central line-associated bloodstream infection (CLABSI), ventilator-associated events and pneumonia, and surgical site infection (SSI). These infections prolong hospitalization, increase complications and mortality, and generate substantial additional costs for patients and health systems (Magill et al., 2018). Importantly, HAIs are not inevitable. Many result from modifiable care processes such as inadequate hand hygiene, incorrect use of personal protective equipment (PPE), lapses in aseptic technique, and inconsistent environmental hygiene.

Infection prevention and control (IPC) is a structured, evidence-based set of practices intended to interrupt transmission of infectious agents in healthcare settings. IPC has both clinical and organizational dimensions: it includes standard precautions and transmission-based precautions, surveillance and outbreak management, environmental cleaning, device-associated infection prevention bundles, occupational exposure management, and collaboration with antimicrobial stewardship programs (WHO, 2016). While policies and infrastructure are essential, IPC ultimately depends on behaviors at the point of care. Healthcare workers (HCWs) translate guidelines into routine actions during high-pressure, complex workflows. Therefore, improving HCW awareness and training is a foundational strategy for preventing HAIs.

Awareness refers to understanding infection risks, routes of transmission, and the rationale for prevention measures. Training refers to structured learning designed to build competence and reliability in IPC practices. Awareness and training are related but not identical: staff may understand a guideline without being able to perform the skill consistently, especially when working under time pressure or unfamiliar conditions. The COVID-19 pandemic reinforced this distinction. Many facilities rapidly expanded IPC training for respiratory protection and PPE donning and doffing. The experience demonstrated both the effectiveness of focused, practical training and the dangers of inconsistent instruction and inadequate reinforcement.

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This paper argues that strengthening IPC awareness and competency-based training among HCWs is a high-impact, scalable approach to reducing HAIs. It aims to: (1) summarize the burden and key drivers of HAIs; (2) explain behavioral mechanisms linking awareness and training to IPC compliance; (3) review evidence for education and multimodal training interventions; (4) identify barriers that reduce training effectiveness; and (5) propose practical strategies for designing and sustaining high-quality IPC training programs.

2. Burden and Drivers of Healthcare-Associated Infections

HAIs are widely recognized as preventable harms and are used as indicators of healthcare quality. Their burden includes direct clinical outcomes such as sepsis, surgical complications, and death; indirect outcomes such as delayed rehabilitation and functional decline; and system outcomes such as increased length of stay, bed shortages, and financial penalties in some health systems. In the United States, large point-prevalence studies have documented that HAIs remain common and that patterns change over time, emphasizing the need for continuous prevention efforts (Magill et al., 2018).

The drivers of HAIs are multifactorial. Patient-related factors include age extremes, immunosuppression, chronic diseases, malnutrition, and the presence of wounds or invasive devices. Clinical care factors include frequency and duration of device use, complexity of surgeries, and intensity of antimicrobial exposure. Environmental factors include crowding, contamination of surfaces, inadequate ventilation in certain contexts, and insufficient cleaning of shared equipment (Weber et al., 2013). Organizational factors include staffing levels, skill mix, turnover, and the availability of supplies and infrastructure.

From an IPC viewpoint, a critical driver is the reliability of routine processes that interrupt transmission. Hand hygiene remains one of the most important and cost-effective measures, yet compliance is often suboptimal (Erasmus et al., 2010). Similarly, improper PPE selection or incorrect donning and doffing can lead to self-contamination and cross-transmission. Lapses in aseptic technique during device insertion and maintenance increase the risk of bloodstream and urinary tract infections. Environmental cleaning failures allow pathogens to persist and spread. Inappropriate antibiotic use promotes colonization and infection with multidrug-resistant organisms, which are more difficult to treat and can spread within facilities (CDC, 2019).

Because many HAIs result from human factors within daily workflows, interventions focused on HCWs are essential. However, effective interventions must address both individual competence and the broader system that shapes behavior. Awareness and training improve capability, but opportunity (time and resources) and motivation (culture and leadership) determine whether safe practices are sustained.

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3. Why Awareness Matters: Knowledge, Risk Perception, and Safety Culture

IPC awareness includes knowledge of transmission routes (contact, droplet, airborne), indications for standard and transmission-based precautions, and understanding why specific practices matter. For example, knowing the "five moments" for hand hygiene helps staff recognize opportunities to prevent transmission between patients and during device manipulation (WHO, 2009). Awareness also includes the ability to identify high-risk situations, such as caring for patients with diarrhea where spores may persist in the environment, or managing invasive devices where small lapses can have serious consequences.

Nevertheless, knowledge alone does not reliably produce behavior change. HCWs may be aware of guidelines yet still fail to comply due to time pressure, competing tasks, or established habits. A key mechanism between awareness and behavior is risk perception. When HCWs perceive infection risk as immediate, personally relevant, and preventable, compliance increases. During outbreaks, compliance often improves because risk becomes salient. As perceived threat decreases, compliance can decline, especially if staff do not see direct feedback linking practices to outcomes.

Safety culture amplifies or undermines awareness. In a strong IPC culture, leaders and senior clinicians model safe behavior, supplies are reliably available, staff are encouraged to speak up, and learning is supported. In weak cultures, workarounds become normalized, and new staff learn unsafe habits. Hierarchical environments may prevent junior staff from correcting unsafe practices by senior colleagues. Therefore, awareness initiatives should be designed to strengthen both knowledge and culture. Communication strategies that share local infection data, patient stories, and lessons learned from investigations can reinforce the relevance of IPC to everyday practice.

Another component of awareness is clarity of responsibility. HCWs may be uncertain about who should disinfect shared devices or when isolation precautions apply. Ambiguity increases the likelihood of gaps. Awareness interventions should provide simple, standardized expectations (for example, "clean after each patient use" for certain equipment) and ensure that workflows support these expectations.

4. Training as Competency: Moving Beyond Information to Practice

Training is most effective when it is competency-based, meaning it focuses on what HCWs can reliably do in practice. IPC competencies include correct hand hygiene technique and timing, appropriate selection of PPE, correct donning and doffing sequence, aseptic technique during invasive procedures, safe sharps handling, cleaning and disinfection of reusable equipment, and prompt response to occupational exposure. Competency-based training uses demonstration, practice, and feedback to make skills routine and robust.

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Didactic sessions are helpful for introducing IPC principles and policy updates, but they often produce limited behavioral change when used alone. Skill acquisition and habit formation typically require interactive methods such as simulation, return demonstration, coached practice at the bedside, and case-based discussions. For example, hands-on PPE training can reduce errors during removal that lead to contamination. Simulation-based training can help teams practice sterile technique, workflow coordination, and communication during central line insertion. "Just-in-time" training, delivered immediately before a high-risk task, can reinforce correct technique and reduce lapses.

Role specificity is another key training principle. Different professional groups have different risk profiles and responsibilities. Nurses may manage devices daily, physicians may perform insertion procedures, laboratory staff handle specimens, and environmental services staff perform cleaning that is essential for breaking transmission. Effective programs tailor content and scenarios to the tasks staff perform. They also address transitions of care, such as moving patients between departments, where IPC lapses are common.

Because healthcare environments change continuously, training must be sustained. Staff turnover and rotation, evolving pathogens, and updated guidelines require ongoing reinforcement. Many organizations therefore combine onboarding training for all new staff, periodic refreshers, targeted sessions based on audit data, and intensified training during outbreaks. Sustainability improves when training is embedded into routine governance rather than treated as an occasional event.

5. Evidence That Education and Multimodal Training Reduce HAIs

The strongest evidence for IPC education comes from programs that combine training with complementary system changes. Hand hygiene improvement is a leading example. The WHO multimodal hand hygiene strategy includes system change (availability of alcohol-based hand rub), education and training, reminders, monitoring and feedback, and institutional safety climate (WHO, 2009). Studies implementing multimodal approaches consistently show improvements in compliance and reductions in HAIs and transmission of resistant organisms. Hospital-wide programs that include education and performance feedback have demonstrated sustained improvements over time when leadership support is strong (Pittet et al., 2000).

Device-associated infection prevention also illustrates the importance of education. Bundled interventions for CLABSI prevention commonly include maximal sterile barrier precautions, chlorhexidine skin antisepsis, checklist use, and standardized maintenance practices. Training is critical to ensure that staff understand each bundle element and can perform it consistently. Programs that pair training with empowerment to stop procedures when sterility is broken and with audit-and-feedback can achieve substantial reductions in CLABSI (Berenholtz et al.,

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2004). Similarly, CAUTI prevention relies on staff training in appropriate indications, aseptic insertion, securement, closed drainage maintenance, and daily review for removal.

Environmental hygiene and equipment disinfection are also influenced by education. Research indicates that surfaces contribute to transmission and that cleaning quality varies; education that clarifies methods, contact times, and accountability can improve cleaning performance (Weber et al., 2013). Training that involves environmental services staff as valued partners, provides hands-on demonstrations, and uses objective feedback (such as fluorescent markers) tends to produce better results than training delivered as general lectures.

A systematic review of hand hygiene compliance studies highlights that knowledge and training are necessary but insufficient without organizational reinforcement (Erasmus et al., 2010). This supports an important conclusion: training reduces HAIs most effectively when it is continuous, role-specific, and reinforced by monitoring, feedback, and supportive leadership. Education is therefore a central pillar of successful multimodal IPC programs.

6. Common Barriers to Effective Training and Sustained Compliance

IPC training programs often face predictable implementation barriers. Time pressure is a major obstacle. HCWs working under heavy workload may miss scheduled sessions, and training designs that ignore shift work and unit coverage may exclude night and weekend staff. When training is perceived as an “extra task” rather than part of clinical work, attendance and engagement decline.

Resource limitations also undermine training. Some facilities have limited access to trainers, simulation equipment, or dedicated education staff. Even when training is available, insufficient supplies can prevent implementation. For example, staff may be trained to use specific PPE types that are not consistently available, or hand rub dispensers may not be placed at convenient points of care. When protocols are taught but cannot be followed due to system constraints, compliance decreases and cynicism grows.

Human factors matter as well. Fatigue, stress, and burnout are associated with attention lapses and reduced adherence to protocols. Over time, repeated exposure to risk without visible consequences can normalize unsafe shortcuts. Hierarchical cultures may discourage speaking up when protocols are violated. In addition, staff may experience “alert fatigue” when reminders are excessive or not tailored.

Fragmented accountability is another barrier. When responsibilities for cleaning shared equipment, managing isolation rooms, or maintaining devices are unclear, tasks may be delayed or omitted. If audits are perceived as punitive, staff may hide problems rather than

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report them. Effective training programs therefore require clear roles, supportive feedback, and a learning-focused environment that encourages reporting and improvement.

Finally, inconsistent messaging can reduce training effectiveness. Different departments may interpret guidelines differently, and rapid updates during outbreaks can create confusion. Training should therefore be standardized, coordinated through IPC leadership, and communicated through clear channels.

7. Designing High-Impact IPC Awareness and Training Programs

High-impact IPC training programs share several design features: (1) clear competencies, (2) accessible and repeated learning opportunities, (3) practical application and coaching at the point of care, (4) measurement and feedback, and (5) leadership engagement.

First, competency-based onboarding should be mandatory for all new staff, including temporary staff and trainees. Onboarding should cover standard precautions, hand hygiene, PPE, isolation practices, sharps safety, specimen handling, and occupational exposure management. For high-risk skills, return demonstration is recommended. Competency checklists reduce variation among trainers and help ensure consistent expectations across departments.

Second, refreshers should be frequent enough to prevent skill decay and should fit clinical realities. Micro-learning modules (5 to 10 minutes) delivered during shift huddles can reinforce key messages without disrupting workflow. E-learning can support flexible completion and can include short quizzes to confirm comprehension. However, online learning should not replace hands-on skill assessments for PPE and aseptic technique.

Third, simulation and bedside coaching are powerful methods for translating knowledge into practice. IPC champions or link nurses can provide unit-based coaching, particularly in high-risk areas such as intensive care units, emergency departments, and operating theaters. Coaching should include immediate feedback and positive reinforcement. Short video demonstrations can standardize teaching and provide quick reminders.

Fourth, monitoring and audit-and-feedback should be routine and transparent. Measurement may include hand hygiene observations, PPE compliance checks, bundle adherence audits, and environmental cleaning verification. Feedback should be timely, unit-specific, and framed as improvement rather than blame. Visual dashboards that show trends over time can maintain engagement and help teams connect behavior to outcomes.

Fifth, leadership engagement is essential. Leaders can protect training time, ensure adequate supplies, and integrate IPC metrics into quality governance. Leaders should also model appropriate behaviors; visible hand hygiene and PPE adherence by senior staff strengthens

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norms. Leadership participation in safety rounds and support for staff who speak up about safety reinforce a culture that sustains training gains.

Practical training elements that many organizations can implement include:

- Standardized onboarding with competency checklists for hand hygiene, PPE, isolation precautions, and aseptic technique.
- Regular micro-learning refreshers and scenario-based discussions during unit huddles.
- Simulation sessions for high-risk procedures (central line support, sterile dressing changes, ventilator care).
- Unit-based IPC champions who coach peers and coordinate quick updates when guidelines change.
- Audit-and-feedback cycles that provide unit-level data on compliance and HAI trends.

8. Integrating Training With Organizational Systems and Quality Improvement

Training becomes more sustainable when it is integrated into organizational systems rather than treated as an isolated education activity. Facilities can link IPC competencies to credentialing and annual appraisal. For example, staff who perform invasive procedures may require evidence of current competency training and periodic reassessment. Unit managers can embed IPC checks into routine rounding and safety briefings.

Quality improvement (QI) methods strengthen training by enabling teams to test changes and learn from data. Plan-Do-Study-Act cycles can be applied to training design and to workflow improvements that support IPC. If compliance is low during busy admission periods, a team might test relocating hand rub, simplifying PPE access, or adding a brief “pause” reminder before certain procedures. Data collected over short cycles help refine interventions and build ownership among frontline staff.

Integration with antimicrobial stewardship is also important. Training can reduce blood culture contamination by improving aseptic collection technique and can improve specimen quality and diagnostic accuracy. Better diagnostics reduce unnecessary antibiotic use and indirectly support HAI prevention by limiting selection pressure for resistant organisms (CDC, 2019). Training that explains this connection helps staff see IPC as part of a broader patient safety strategy.

Digital tools can extend the reach of training. Learning management systems can track completion and identify gaps. QR codes placed at points of care can link to short videos and checklists. Mobile prompts and electronic dashboards can reinforce expectations. However, digital tools should complement, not replace, supportive supervision and hands-on competency assessment.

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9. Special Considerations: High-Risk Areas and Emerging Threats

High-risk areas require intensified and tailored training because transmission opportunities and patient vulnerability are greater. Intensive care units and operating rooms should prioritize device bundle training, sterile technique, and environmental controls. Emergency departments require emphasis on rapid triage, early isolation, and consistent PPE use under time pressure, as well as clear pathways for suspected airborne or droplet-transmitted infections. Dialysis units require strong focus on bloodborne pathogen prevention and disinfection between patients.

Training must also adapt to emerging threats. Novel respiratory viruses, outbreaks of multidrug-resistant organisms, and seasonal surges (such as influenza) require flexible "just-in-time" modules with clear updates. After-action reviews following outbreaks and clusters can identify learning needs and improve preparedness. During rapidly evolving events, standardized messaging and coordinated training reduce confusion and variability.

Equity and inclusion among staff are essential. Environmental services, porters, and other support staff play a central role in IPC and should receive role-appropriate training and recognition. Facilities should consider language needs, literacy levels, and culturally appropriate teaching methods. Respectful engagement improves participation and reduces the perception that IPC is "someone else's job."

10. Discussion

Enhancing IPC awareness and training is a proven approach to reduce HAIs, but outcomes depend on program design and context. Awareness campaigns can increase knowledge and motivation, especially when they communicate clearly and use local data. Training builds competence, but competence will not translate into sustained behavior if workloads, staffing, and supplies make compliance unrealistic. Therefore, the most successful initiatives align capability (knowledge and skill) with opportunity (resources and workflow design) and motivation (culture, leadership, and feedback).

The literature supports multimodal approaches. This is consistent with behavioral science frameworks in which behavior change requires both internal capability and external reinforcement. In practice, hospitals should conduct a needs assessment using audit results, incident reports, and HAI surveillance to identify the highest-impact training targets. For example, if audits show frequent PPE doffing errors, targeted simulation and coached practice should be prioritized. If CLABSI rates rise, refresher training on insertion and maintenance bundles should be paired with checklist use and monitoring.

Measurement should remain meaningful and credible. Over-reliance on superficial metrics can create "checkbox compliance" without genuine behavior change. Combining process

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measures (hand hygiene compliance, bundle adherence) with outcome measures (HAI rates) helps teams understand impact. Transparency is important: frontline staff should see unit-level data, participate in interpreting results, and be supported to test improvements.

Training is often cost-effective. HAIs are costly, and even modest reductions can offset training investment through reduced length of stay and fewer complications. In many settings, the main costs are staff time and coordination rather than expensive equipment. Designing training to fit workflows, using brief modules, bedside coaching, and integration into existing meetings can increase feasibility while maintaining quality.

Overall, IPC awareness and training are necessary but not sufficient alone. Their impact is maximized when supported by leadership, adequate resources, consistent policies, and continuous improvement.

11. Conclusion

Healthcare-associated infections remain a preventable source of harm in healthcare systems. Because HCWs directly influence infection transmission through routine care processes, enhancing their awareness and training is a cornerstone of HAI prevention. Awareness builds understanding and risk perception; competency-based training builds reliable skills and supports behavior change. Evidence indicates that sustained, role-specific education embedded within multimodal IPC strategies improves compliance and is associated with reduced infection rates.

Healthcare organizations should invest in structured onboarding, frequent refreshers, simulation and bedside coaching, and audit-and-feedback mechanisms. Leaders should ensure that resources and workflows support compliance and that safety culture encourages speaking up and learning. By strengthening IPC awareness and training, facilities can reduce HAIs, protect the workforce, support antimicrobial stewardship, and improve the overall quality and resilience of care delivery.

12. Practical Recommendations for Hospitals

Hospitals that aim to reduce HAIs through workforce development can use a short, structured playbook. The goal is not to add training for its own sake, but to ensure that every critical IPC behavior is easy to perform, repeatedly practiced, and consistently reinforced. Recommendations should be adapted to local risk profiles (e.g., ICU device use, surgical volume, emergency department crowding) and supported by visible leadership commitment.

A practical approach is to define a small set of high-priority competencies (for example: hand hygiene, PPE, aseptic device care, and environmental disinfection of shared equipment), then implement an annual cycle that combines onboarding, refreshers, auditing, and targeted

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improvement. Facilities should protect training time, maintain reliable supplies, and standardize messaging so that staff do not receive conflicting instructions across departments.

- Make competency checks mandatory for PPE donning and doffing and for aseptic technique in high-risk tasks; use return demonstration rather than lecture-only training.
- Use brief, repeated micro-learning (5 to 10 minutes) during shift huddles, supported by quick-access videos and checklists at points of care.
- Create unit-based IPC champions who provide coaching, answer questions in real time, and support rapid roll-out of guideline updates during outbreaks.
- Run monthly audit-and-feedback cycles focused on a small number of behaviors; share unit-level dashboards and celebrate improvements publicly.
- Link training to outcomes by reviewing local HAI cases and near-misses in a blame-free manner and translating lessons into specific practice changes.

When these steps are implemented together, training becomes a routine part of safe care rather than an intermittent event. Over time, consistent reinforcement helps convert IPC behaviors into unit norms, improving reliability even during periods of high workload and staff turnover.

References (APA 7th Edition)

1. Allegranzi, B., & Pittet, D. (2009). Role of hand hygiene in healthcare-associated infection prevention. Journal of Hospital Infection, 73(4), 305-315.
2. Berenholtz, S. M., Pronovost, P. J., Lipsett, P. A., Hobson, D., Earsing, K., Farley, J. E., Milanovich, S., Garrett-Mayer, E., Winters, B. D., Rubin, H. R., Dorman, T., & Perl, T. M. (2004). Eliminating catheter-related bloodstream infections in the intensive care unit. Critical Care Medicine, 32(10), 2014-2020.
3. Centers for Disease Control and Prevention. (2019). Antibiotic resistance threats in the United States, 2019. U.S. Department of Health and Human Services.
4. Erasmus, V., Daha, T. J., Brug, H., Richardus, J. H., Behrendt, M. D., Vos, M. C., & van Beeck, E. F. (2010). Systematic review of studies on compliance with hand hygiene guidelines in hospital care. Infection Control & Hospital Epidemiology, 31(3), 283-294.
5. Krein, S. L., Kowalski, C. P., Hofer, T. P., Saint, S., & Olmsted, R. N. (2012). Preventing hospital-acquired infections: A national survey of practices reported by U.S. hospitals. Journal of General Internal Medicine, 27(7), 773-779.
6. Loveday, H. P., Wilson, J. A., Pratt, R. J., Golsorkhi, M., Tingle, A., Bak, A., Browne, J., Prieto, J., & Wilcox, M. (2014). epic3: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. Journal of Hospital Infection, 86(S1), S1-S70.

Power System Technology
ISSN:1000-3673
Received: 16-08-2025 Revised: 05-09-2025 Accepted: 25-10-2025

7. Magill, S. S., O'Leary, E., Janelle, S. J., Thompson, D. L., Dumyati, G., Nadle, J., Wilson, L. E., Kainer, M. A., Lynfield, R., Greissman, S., Ray, S. M., Beldavs, Z., Gross, C., Bamberg, W., Sievers, M., Concannon, C., Buhr, N., Warnke, L., Maloney, M., ... Fridkin, S. K. (2018). Changes in prevalence of health care-associated infections in U.S. hospitals. New England Journal of Medicine, 379(18), 1732-1744.
8. Pittet, D., Hugonnet, S., Harbarth, S., Mourouga, P., Sauvan, V., Touveneau, S., & Perneger, T. V. (2000). Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. The Lancet, 356(9238), 1307-1312.
9. Siegel, J. D., Rhinehart, E., Jackson, M., & Chiarello, L. (2007). Guideline for isolation precautions: Preventing transmission of infectious agents in healthcare settings. American Journal of Infection Control, 35(10 Suppl 2), S65-S164.
10. Tartari, E., Pires, D., Bellissimo-Rodrigues, F., et al. (2017). The global implementation of the WHO multimodal strategy for hand hygiene improvement: A systematic review. Journal of Hospital Infection, 95(1), 31-34.
11. Weber, D. J., Anderson, D., & Rutala, W. A. (2013). The role of the surface environment in healthcare-associated infections. Current Opinion in Infectious Diseases, 26(4), 338-344.
12. World Health Organization. (2009). WHO guidelines on hand hygiene in health care: First global patient safety challenge - Clean care is safer care.
13. World Health Organization. (2016). Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level.
14. World Health Organization. (2020). Infection prevention and control during health care when coronavirus disease (COVID-19) is suspected or confirmed: Interim guidance.
15. Yokoe, D. S., Anderson, D. J., Berenholtz, S. M., Calfee, D. P., Dubberke, E. R., Ellingson, K., Gerding, D. N., Haas, J. P., Kaye, K. S., Klompas, M., Lo, E., Marschall, J., Mermel, L. A., Nicolle, L. E., Salgado, C. D., Bryant, K., & Classen, D. (2014). A compendium of strategies to prevent healthcare-associated infections in acute care hospitals: 2014 updates. Infection Control & Hospital Epidemiology, 35(8), 967-977.