Saudi Journal of Medicine and Public Health

https://saudijmph.com/index.php/pub

https://doi.org/10.64483/202412464

Assessment of Nurses' Knowledge and Compliance with Infection Control Practices in Healthcare Settings

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Abstract

Prevention of healthcare-associated infections (HAIs) is an essential element of patient safety and quality care provision by nurses since the prevention of infections is a core aspect of quality healthcare delivery. In this research paper, the researcher will explore the knowledge and practice of nurses focused on infection control measures and how this relates to the factors that affect the compliance of nurses in clinical settings. The study also demonstrates the main points of infection prevention such as hand hygiene, wearing of personal protective gear, safe injection, cleaning of the environment and following isolation precautions. It also compares the relationship between the knowledge of nurses with the real clinical practice and the role of training, monitoring, and organizational support on compliance to infection control. So-called barriers to efficient implementation, including workload, resource constraint and lack of training are addressed. The results focus on the fact that sufficient knowledge is necessary, but must be supplemented with ongoing learning, mentoring, and organizational policies to become effective practice. The prevention of HAIs via strengthened infection control programs by providing specific training on the topic and supportive healthcare systems can contribute greatly to reducing HAIs and improving patient safety. The author highlights the significance of incorporating infection control concepts into nursing practice, learning, and policy-making to facilitate safe and of quality healthcare settings.

Keywords

Infection Control, Nurses Knowledge, Nursing Practice, Healthcare-Associated Infection, Patient Safety, Standard Precautions

Introduction

HAIs are a significant burden to healthcare systems around the globe since they are known to promote morbidity, mortality, and healthcare expenditures. Infection control measures are the necessary interventions, which are aimed at the prevention of spreading of infectious agents in health care facilities. As the greatest number of healthcare specialists and primary caretakers, nurses greatly contribute to these measures and patient safety.The ability of nurses to exercise effective infection control depends on the knowledge, attitudes, and compliance with the set guidelines and policies. Hand hygiene, donning personal protective equipment, safe injection practice, environmental cleaning, and isolation are some of the practices that form the basis of mitigating the risk of infection. Nonetheless, there is a lack of adherence to the infection control measures, even though evidence-based guidelines are available.

Knowledge of the factors that impact on the knowledge and practice of nurses is critical towards identification of gaps and enhancement of the infection prevention practices. One of the key factors that influence compliance levels is training, supervision, resource availability, and support of the organization. This study will focus on knowledge and practice of nurses regarding infection control measures, potential barriers to the effective adoption and application of these measures, and the implication of infection control practices on patient safety. With these concerns, health facilities will be capable of supporting infection control learning and improve nursing care quality.[1,2]

Infection Control: Scope and Relevance in Nurse Care.

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Receive Date: 19 December 2024, Revise Date: 30 December 2024, Accept Date: 31 December 2024

Nursing care includes the process of infection control as its essential element, which is vital to the patient safety and quality of healthcare provision. Nurses are continually involved in the infection control domain which cuts across all healthcare facilities such as hospitals, clinics, long-term care facilities and the community health environment. The nurses are in the direct line of caring patients therefore are in constant contact with the patients, the medical equipment and the environment in the area which puts them in a strategic position to prevent and manage the spread of infections.Infection control encompasses a large variety of activities which include hand hygiene, use of personal protective equipment (PPE), safe sharps, Environmental cleaning and waste management, as well as conformity to isolation precautions. The following measures are meant to minimize the spread of infectious agents among patients, health care workers, and visitors. Nurses are entrusted with the responsibility of implementing such practices besides keeping track of the health status of patients, identifying cases of infections at an early stage and reporting outbreaks early enough.[3]The need and importance of infection control in nursing care have thus grown tremendously with the growing incidence of healthcare-associated infections (HAIs), antimicrobial resistance, and emergent infectious diseases. Best infection control measures will aid in the mitigation of morbidity, mortality, length of stay, and healthcare expenses. Additionally, compliance with infection control protocols increases the confidence of the population in the healthcare systems and safeguard the health care workers against workplace exposures.Professional accountability and ethical practice are closely associated with infection control in the nursing care. The nurses are supposed to adhere to evidence-based guidelines and policies by an institution to provide a safe care environment. Thus, knowledge of the extent and applicability of infection control makes nurses deliver the quality, safe, and patient-centered care with minimal avoidable infections.[4]

Definition and Concept of Infection Control Measures.

Infection control measures are evidence based practices and procedures that are aimed at reducing or eliminating the spread of infectious agents in healthcare institutions. These are meant to interrupt the pathogenesis of infection by managing conditions leading to infection, interrupting the transmission pathways, and shielding vulnerable hosts. As a nurse, infection control measures are part of the day-to-day clinical practice.

Infection control, in conceptual sense, is founded on the fact that micro-organisms may be spread in direct contact, indirect contact, by droplets, in the air, or through contaminated surfaces and equipment. Controlling these modes of transmission is therefore organized in the form of infection control. The standard precautions are the base of infection control and are used on all the patients irrespective of their infections. These are hand hygiene, wearing gloves and mask, respiratory hygiene and safe injection.Besides the usual precautions, there are transmission-based precautions which include contact precautions, droplet precautions and airborne precautions, which are enforced in situations where patients are known or suspected of specific infectious diseases. Use of sterilization and disinfection of medical equipment, appropriate waste disposal, handling of linen and environmental cleanliness are also other means of infection prevention.[5]In the nursing viewpoint, measures in infection control can be preventive and protective. They not only keep patients off the path of getting infected in the course of treatment but also prevent occupational exposures of the nurses to the pathogens. The definition and knowledge of these measures are essential because when these actions are not performed correctly, the rate of infection, as well as patient results, can be deteriorated. The infection control measures are hence a planned, systematic process of achieving safety and quality in care delivery.[6]

Significance of Infection Control in Nursing.

Infection control is a key issue in the nursing practice, as it directly relates to patient safety, quality of care, and health outcomes. The implementation of healthcare-associated infections prevention (HAIs) is a crucial mission of nurses as the latter represents one of the most frequent and severe complications of hospitalization. Strong infection control measures play a significant role in lowering the possibility of infection transmission and also lead to better recovery and lower mortality rate. The close and constant exposure of the nurses to the patients is one of the major reasons why infection control is a significant issue in the nursing practice. This constant interaction exposes the risks of cross-contamination in case of the lack of appropriate measures. Nurses can contribute to the safety of the vulnerable patient groups, including the neonates, aged, immunocompromised, and those with chronic diseases by following infection control protocols.[7]The needs of protecting the nurses themselves also include infection control. A high occupational risk is exposure to bloodborne pathogens, respiratory infection and multidrug-resistant organisms. The risk of contracting an infection and injuries at the workplace can be minimized by using personal protective equipment, good hand hygiene, and safe sharp handling.Moreover, the proper infection control measures also lead to a decrease in the total cost of healthcare through fewer and shorter hospitalization durations, readmissions, and extra medicines. They also assist in meeting the national and international standards and accreditation standards of healthcare.Infection control is an aspect of professional competence, ethical responsibility, and dedication to patient-centered care in nursing practice. Therefore, continuous [8]

Healthcare-Associated Infection (HAIs) Epidemiology.

HAIs are infections that patients contract during the process of receiving healthcare services in hospitals that were neither present nor propagating at the time of the admission. HAIs are a significant worldwide health issue, which annually affects millions of patients and leads to significant morbidity, mortality, and augmented healthcare expenditures. HAIs have different epidemiology depending on the regions, healthcare background or setting, and the particular patients, but they have a high burden especially in the intensive care units, surgical wards, and when dealing with long-term care patients.A common example of HAIs is catheter-associated urinary tract infections (CAUTIs), central line-associated bloodstream infections (CLABSIs), ventilator-associated pneumonia (VAP), and surgical site infections (SSIs). Such infections are commonly caused by bacteria like Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae and Pseudomonas aeruginosa, most of which are antimicrobial resistant. Multidrug-resistant organisms have also emerged, which has enhanced the burden of preventing and treating HAIs in the world.[9]HAIs are caused by a number of risk factors such as extended hospital stay, invasive medical surgery, immunosuppression, old age, and the lack of compliance with infection control measures. Another factor that contributes to the spread of pathogens is the environmental pollution and poor sanitization of medical equipment.One of the strategies of understanding and controlling HAIs is epidemiological surveillance. Correct data collection, reporting, and tracking of the infections assist in recognizing the trends, outbreaks, and risk areas in healthcare facilities. Knowledge about the epidemiology of HAIs is the key to creating effective infection prevention programs and emphasizing the necessity to emphasize on the importance of following the infection control rules strictly to decrease their impact on the global burden.[10]

The contribution of Nurses in Preventing Healthcare-Associated Infections.

The nurses focus on the prevention of healthcare-associated infections as they spend the majority of time at the bedside of patients and are involved with virtually all areas of patient care. Nurses being the frontline healthcare providers have the responsibility of putting in place the infection control measures and compliance with the laid down guidelines and protocols. Their behaviors largely contribute to the rate of HAIs and patient safety.Proper hand hygiene practice and promotion is one of the major roles of nurses in preventing infections. Hand hygiene has been established to be the best action towards preventing the spread of infection. The appropriate usage of the personal protective equipment (PPE) including gloves, gowns, masks, and eye protection is also the duty of nurses depending on the severity of the risk to the patient and the transmission pathway.[11]Moreover, nurses have a vital role in ensuring aseptic practices even when using invasive procedures, such as inserting catheters, wound management, and administration of drugs. They observe patients with the view to detecting any early infection, record the findings correctly and report the same to the health team in time. Nurses also inform patients and their families on how to prevent infections, including hand hygiene and respiratory etiquette, when in the hospital and also when they are at home.Moreover, the nurses can help control the infections by engaging in the surveillance activities, quality improvement efforts as well as infection prevention committees. Continuous education and training help nurses to be abreast with evidence-based practices. Nurses play a crucial role in preventing the occurrence of HAIs and enhancing health outcomes through vigilance, protocols and educating patients.[12]

Normal Precautions and the way they can be applied to nursing care.

Standard precautions refer to a collection of infection prevention measures that are implemented in regards to the care of all patients irrespective of their diagnosis or infection status. These measures are aimed at minimizing the risk of infectious agent transmission in healthcare facilities and are the basis of infection control in nursing care. The concept of standard precautions presupposes that every blood, body fluids, secretions and excretions can be potentially infectious.The main elements of standard precautions are hand hygiene, personal protective equipment (PPE), respiratory, safe injections, and handling of contaminated equipment and waste. Standard precautions are based on hand hygiene which should be observed prior to and after contact with the patient, exposure to body fluids, and doffing of gloves.[13]PPE (gloves, gowns, masks, and eye protection) should be used accordingly depending on the estimated exposure to infectious material. To prevent infections of patients and self-infection, the task of nurses is to choose and wear PPE properly. Safe injection practices such as using sterile needles and syringes and disposing sharps well are very important in prevention of bloodborne infections.Standards precautions must be routinely observed and used professionally in the nursing care. Nurses are required to incorporate these practices in their daily care activities such as administration of medications, wound dressing and mobility of patients. There should be education, supervision, and institutional support to promote compliance. The proper use of standard precautions would go a long way in minimizing the risk of infections and enhancing a healthy healthcare environment.[14]

Hand Hygiene Knowledge and Compliance Among Nurses

Hand hygiene is generally accepted as the greatest and easiest tool of preventing nosocomial infection

spreading in a healthcare environment. The understanding of the principles of hand hygiene by nurses becomes essential to guarantee an adequate adherence rate and decrease healthcare-associated infections (HAIs). Sufficient knowledge entails the knowledge of the cues of hand hygiene, proper methods and the appropriate application of handwashing using soap and water as opposed to using alcohol-based hand rubs.Although the hand hygiene has been proved to be of high quality, nurses tend to observe poor compliance. Issues affecting compliance are workload, time limitation, supply of hand hygiene, irritation of the skin due to frequent handwashing, and insufficient training. Access to hand hygiene supplies is also not good in certain healthcare environments thus, compromising compliance. The more educated nurses who have continued education are more likely to exhibit compliance and awareness to hand hygiene rules.[15]Organizational culture and leadership support also determine hand hygiene compliance. Patients facilities that encourage safety, conduct routine observation, and provide feedback on the performance of hand hygiene are more likely to have high compliance rates. Also, positive behavior is promoted among staff members through role modeling by the senior nurses and infection control teams.To increase compliance, nurses should be improved in terms of knowledge via constant learning, reminders, and evidence-based recommendations. Audits and feedback system of hand hygiene may aid in identifying the gaps and strengthening the good practices. High standards of hand hygiene knowledge and adherence enable nurses to reduce the transmission of infection, protect patients and health care professionals as well as make health care settings safer.[16]

Wearing of Personal Protection Equipment (PPE) in Clinical Practice.

Infection prevention and control in clinical practice involves the use of personal protective equipment (PPE). PPE comprises of gloves, gowns, masks, respirators, face shields, eye protection and so on, which are used to block exposures of healthcare workers and patients to infectious agents. Closeness and frequent contact with patients make nurses often use PPE because of their close and constant interaction with patients.Due to the mode of transmission and exposure risk, the correct use of PPE depends on the type of information regarding when and how to use each of the equipment materials. Gowns preserve clothing and skin, whereas gloves help to avoid contact with body fluids and blood. The masks and respirators minimize the contact with the respiratory droplets and airborne pathogens, and the eye protection helps to keep the mucous membranes off splashes.[17]There are issues associated with the PPE usage, such as shortages, discomfort, training, and incorrect donning and doffing methods. Misuse of PPE may enhance chances of contamination and not prevent it. The necessity of proper supply of PPE and training was especially clear during outbreaks and pandemics, such as the COVID-19.The personnel must be educated to use PPE properly, and nurses have a critical part in this process as they can educate patients and other nurses by following the recommendations and teaching about its importance. The compliance should be enhanced by regular training and availability of PPE, as well as clear institutional policies. Proper utilization of PPE helps to shield nurses against occupational risks and helps to prevent healthcare-associated infections.[18]

Safe Sharps Disposal and Injection.

The elements of the infection control in nursing practice include safe injection practices and safe sharps disposal. The objectives of these practices are to avoid the spread of blood-borne pathogens including hepatitis B, hepatitis C and human immunodeficiency virus (HIV) among patients and health care providers. Nurses are likely to handle sharps and injections and, hence, their compliance with the safety measures becomes paramount.The safe injection practices are the use of sterile single use needles and syringes per injection, preparation of injections in clean places and use of aseptic technique. Even with the same patient, reusing needles or syringes is very dangerous in terms of infection. Other practices that should be avoided by nurses include recapping needles, which expose the nurses to the risk of needlestick injuries to a great extent.[19]Sharps disposal is a procedure whereby used needles, syringes and other sharp objects are promptly disposed of in puncture and leak resistant sharps containers. These containers are supposed to have labels and be easily available at the point of care. Sharps must not be overfilled as this puts a person at risk of accidental injury.The issue of compliance with safe injection and sharps disposal guidelines needs to be handled by educating and training nurses. Safety is also improved through institutional support, safety-engineered devices, and mechanisms of reporting needlestick injuries. Correct injection and sharps disposal ensure the safety of both patients and healthcare providers and both help in making the healthcare a safer place.[20]

Practice of Environmental Cleaning and Disinfection.

Infection prevention and control in healthcare facilities involves environmental cleaning and disinfection. Unless effectively cleaned and disinfected, the healthcare environment (surface, medical equipments, and patient-care space) can be sources of pathogenic microorganisms. Infected environments are also factors that contribute to the spread of healthcare-associated infections (HAIs), especially in intensive care units, operating rooms, and isolation wards.Environmental cleaning entails physical deletion of dirt, organic substances and microorganisms on surfaces through the use of detergent and water. Disinfection is defined as the application of chemical agents to either kill or destroy pathogenic micro organism on non-living surfaces and

equipment. When it comes to patient-care zones, nurses are crucial in keeping them clean as per the acceptable standards of cleaning against infections, despite the presence of special cleaning personnel.[21]Surface areas that are high-touch include bed rails, doorknobs, bedside tables, infusion pump, and monitors, which should be thoroughly cleaned on a regular basis. Medical equipment should be shared and washed and disinfected between patients to avoid cross-contamination. Having an inappropriate cleaning routin, inappropriate use of disinfectants, or not adhering to the suggested contact times may lead to a decreased efficiency of disinfectant processes.[22]Training and education are very important in making sure that nurses appreciate proper cleaning procedures and the proper use of disinfectants. Compliance and consistency are enhanced by clear institutional policy, regular audit and oversight. Good environmental cleaning/disinfection practices are very effective in reducing the risk of infection, promoting patient safety, and enhancing a clean and safe healthcare environment. [23]

Isolation Precautions and Transmission-Based Measures

The isolation precautions and transmission-oriented measures are introduced to stop the dissemination of infectious agents that are spread by contact, droplet, or airborne channels. Such precautions are applied alongside the normal precautions when patients are known or suspected to have infectious diseases that will be dangerous to others. The nurses are in the heart of the isolation measures implementation and monitoring.Transmission precaution is divided into contact precautions that prevent infections that are transmitted by direct or indirect contact, droplet precautions that prevent infections transmitted by respiratory droplets, airborne precautions to prevent infections transmitted by airborne particles. Such measures can include assigning patients to single rooms, applying the relevant personal protective equipment (PPE), restrict patient movement, and proper ventilation.[24]Nurses have the duty of isolating patients, enforcing the necessary precautions and informing patient, families and visitors on the process of isolation. Lack of proper implementation of isolation measures may result in outbreak and spread of the infection in healthcare facilities.The successful use of isolation precaution measures demands sufficient resources, guidelines, and training of the staff. Possible obstacles like a shortage of isolation rooms, workload stress, and noncompliance might affect the effectiveness. Transmission-based measures should be applied consistently to ensure the protection of patients, healthcare workers, and the community in general against infectious diseases.[25]

Knowledge of Infection Control Guidelines and Policies by nurses.

The awareness of the nurses on the policies and guidelines of infection control is one of the main factors that will influence the safe and efficient clinical practice. National and international health organizations have developed infection control guidelines which are evidence based guidelines on preventing and management of infections in healthcare environment. Institutional policies will convert these guidelines into work practices that are to be adhered to by nurses.A good understanding of the infection control measures will empower the nurses to employ standard precautions and transmission based precautions properly and consistently. This is such things as learning about hand hygiene procedures, personal protective gear, cleaning of the environment, and exposure management procedures. Well-informed nurses can be expected to adhere to guidelines and help to decrease the prevalence of healthcare-associated infections.[26]Nonetheless, knowledge gaps can occur because of the lack of training, the outdated information, or the lack of access to guidelines. Nurses who have recently graduated and nurses who are exposed to a high level of stress can be the most susceptible ones to knowledge shortages. These challenges need to be dealt with by continuous learning and updates, by means of available policy documents.Healthcare institutions are very important in improving the knowledge of nurses in terms of orientation programs, constant training programs, and adherence to these programs. Enhancing nurses knowledge in infection control policy and guidelines enhances patient safety, professional integrity and overall quality of healthcare services.[27]

Issues that affect the knowledge of nurses on infection control.

The selection of individual, organizational and educational factors caused by the combination of these factors determine the amount of knowledge that nurses have on matters relating to infection control. Some of the most significant determinants are education level and professional training. The higher the knowledge level is, the more formal education nurses have obtained about infection prevention and the more continuous professional development programs they have attended. In-service training, workshops and educational material revision improve the knowledge of the principles of infection control and existing guidelines.[28]Clinical experience is also significant in influencing the knowledge of the nurses. The practice of experienced nurses may help develop practical knowledge of infection control due to constant experience relating to the situation. Nevertheless, experience in itself might not guarantee proper knowledge when it is not backed up with evidence-based changes. Knowledge also depends on access to current infection control guidelines, protocols and institutional policies.The workplace culture and organizational support play a major role in influencing the learning opportunities of nurses. Healthcare institutions that value patient safety, invest resources in training, and promote compliance with infection control criteria promote the development of

knowledge by the nursing staff. The mechanisms of leadership support, supervision, and feedback support proper practices and help with continuous learning.[29]Also, the workload and staffing may have an impact on knowledge acquisition. It is possible that the high patient-to-nurse ratios, and time constraints, prevent the training and self-directed learning opportunities. Personal factors, including motivation, attitude to infection prevention and perceived risk of infection, influence the interest of nurses to the infection control education as well. It is critical to comprehend these influencing factors to design the successful educational interventions, enhance the knowledge and adherence to infection control measures among nurses.[30]

Evaluation of Infection Control practices amongst Nurses.

Evaluating infection control practices of nurses is important to determine the adherence to the laid down guidelines and areas that need to be identified to enhance the practice. The assessment techniques offer good information on the way infection control measures are implemented in the everyday clinical practice and contribute towards patient safety. Some of the widely used assessment methods are direct observation, self-administered questionnaires, audit and examination of the infection surveillance data.Direct observation is regarded as being among the most effective ways of measuring practices, including hand hygiene, wearing of personal protective equipment, and aseptic procedures. It can however be subject to Hawthorne effect, whereby the nurses change their behaviors upon realizing that they are being watched. Self-reported assessments and questionnaires will be helpful in measuring knowledge and attitudes but will not be a clear picture of practice.[31]Audits and performance indicators that monitor compliance are highly practiced in healthcare institutions. Such audits evaluate compliance with standard precautions, environmental cleaning measures and safe injection measures. The outcomes assist in recognizing the gaps, directing the training programs, and aiding the quality improvement efforts.Consistent review of infection control activities encourages responsibility and constant enhancement. Assessment feedback prompts nurses to follow the best practices and supports the value of preventing infections. With education and supervision, effective assessment systems have a role to play in infection reduction and improvement of the quality of nursing care.[32]

Obstacles to Good Infection Control Practice by Nurses.

Although infection control guidelines are available, the nurses have challenges that tend to impede the successful application to clinical practice. High workload and shortage of staff is one of the most frequent obstacles, whereby there is a limited time to adhere to infection control protocols. The large number of patients can create the possibility of missing hand hygiene opportunities or not wearing personal protective equipment.Another important obstacle is the shortage of resources. Lack of personal protective equipment, hand hygiene products or effective sharps containers also undermines compliance. In other environments, lack of good infrastructure and overcrowded wards also increase the risk of infections.Weaknesses in training and knowledge deficits are also putting a strain on favorable infection control practice. Nurses not updated on a regular basis or provided with practical training might not be aware of current guidelines and correct techniques. Moreover, the adherence to infection control measures can be decreased by the negative attitudes, low level of risk perception, and the lack of motivation.[33]Poor compliance is achieved because of organizational and managerial reasons, including the ineffective leadership support, the lack of supervision, and the absence of monitoring systems. To overcome these barriers, it is necessary to implement a complex solution, namely a sufficient number of personnel, resources, ongoing training, and firm commitment of the institution and motivation to prevent infections and patients.[34]

Knowledge, Practice Relationship in Infection Control.

The connection between knowledge and practice in infection control is a very serious field of interest in healthcare research, especially in nursing. Knowledge is the concept indicating how nurses are aware of the principles, guidelines, and procedures of infection control and practice is the concept that actual reflects how the knowledge is utilized in the clinical environments. Despite the fact that sufficient knowledge is a requirement of effective infection control, it is not necessarily a guarantee of good practice.The research evidence has indicated that those nurses possessing a better level of knowledge of infection control in general are more likely to comply with the standard precautions, hand hygiene, and the utilization of personal protective equipment. The level of knowledge will improve risk awareness of infection spread and the benefits of adopting preventive measures. Nevertheless, there are usually gaps between the knowledge and practice of nurses because of some personal and structural factors.[35]Knowledge to practice may be hampered by factors like workload, time strain, scarce resources and institutional support. Well-informed nurses might not be able to adhere to infection control strategies in high-demand clinical settings on a regular basis. Moreover, practice is also influenced by attitude, beliefs, and perceived vulnerability to infection and is also likely to mediate between knowledge and behavior.Educational interventions are not sufficient to address the gap between knowledge and practice. Correct practices need to be supported by positive workplace cultures, commitment on the part of leadership, availability of resources and constant monitoring. The knowledge-practice relationship is

essential in enabling healthcare organizations to formulate effective strategies that will encourage the process of learning and the constant application of the infection control practices, which will lead to the reduction of healthcare-associated infections and enhance patient safety.[36]

Infection Control Training and Education.

The basis of enhancing the knowledge, skills, and adherence of nurses to infection control measures is training and educational programs. The programs will provide nurses with the current, evidence-based information on the prevention of infections, standard precautions, and emerging threats of infections. Constant learning is particularly necessary in healthcare settings, where guidelines and technologies are being continuously changed.Good infection control training programs apply diverse educational methods, such as lectures, workshops, simulations, and learning modules online. On-job training will enable the nurses to acquire the skills of hand hygiene methods, correct usage of personal protective gears, aseptic procedures, and waste management. The reinforcement of the proper behaviors and confidence in risky situations are especially the areas where simulation-based training comes in handy.[37]The orientation programs of newly hired nurses are essential in creating a sound base in regards to the practices of infection control. Also, the knowledge can be strengthened by regular refresher courses that are intended to address the gaps that have been revealed as a result of the audit or assessment. Designing education interventions according to clinical environments and risk factors promotes their applicability and usefulness.Medical facilities ought to help in the training programs by providing sufficient time, materials, as well as skilled teachers. Pre- and post-assessments of the training will help to test the impact of the training and maintain the improvement. Effective educational interventions also play an important role in better compliance, lowering infection rates, and improving the quality of the nursing care.[38]

Supervision, Supervision and Compliance Strategies.

Infection control programs in healthcare facilities are unthinkable without monitoring, supervision, and compliance strategies. These plans make sure that infection prevention plans are followed on a regular basis and assists in determining areas that need enhancement. Providing constant monitoring enables healthcare organizations to monitor the compliance with the measures to prevent infection and evaluate their outcomes on patients.Widely used surveillance tools are direct observation, audit, performance indicators and infection surveillance systems. Hand hygiene and use of personal protective equipments are often checked using direct observation, and the compliance with standard precautions and environmental cleaning procedures is audited. The information on infection surveillance is used to identify the trends and outbreaks, and focus on the appropriate interventions.[39]The supervision will be critical to strengthening the compliance. Nurse managers, infection control groups, and clinical supervisors offer guidance and support and feedback to nursing personnel. Compliance with infection control practices is promoted with positive reinforcement, role modeling and positive feedback. Accountable hierarchies also foster responsibility amongst healthcare professionals.The strategy of compliance must be oriented towards education, motivation and system improvement as opposed to punishment. Having the right resources, streamlining processes and creating a safety culture helps in increasing compliance. Monitoring and supervision strategies can empower the infection control practice, decrease healthcare-associated infections, and ensure a safe and high-quality healthcare environment when effectively implemented.[40]

Effect of Infection Control on Patient Safety.

Infection control measures largely influence patient safety and the general quality of health services provided. The application of effective measures to prevent infections is highly effective in reducing the occurrence of healthcare-associated infections (HAIs), which ranks among the most frequent adverse events in the hospitalized patients. HAIs augment morbidity, mortality, length of stay, and healthcare expenses, and infection control is an essential patient safety issue.[41,42]Compliance with standard precautions, hand hygiene, the use of personal protective equipment, safe injection, and environmental cleaning go directly to keep patients out of the way of infectious agents. Strict infection control measures are especially helpful to vulnerable populations, including neonates, patients who are too old, and those with weakened immune systems. When the practices are regularly observed, the chances of cross-transmission of pathogens among patients, healthcare workers, and healthcare environment are significantly lowered. Patient confidence and trust in healthcare systems are also promoted when the practice focuses on infection control. Safe care environment reduces the preventable complications and promotes the positive clinical outcomes. Moreover, proper infection control helps in achieving antimicrobial stewardship since antibiotics are not used unnecessarily as a result of proper infection management hence avoiding antimicrobial resistance.[43]Patient safety has been directly related to the performance of the healthcare workers, particularly nurses who are in direct contact with the patients. The need to provide long-term compliance with infection control practices is sufficient and requires continuous monitoring, education, and institutional support. In general, effective infection control initiatives are premises of patient protection, enhancement of healthcare quality, and the best safety outcomes.[44,45]

Nursing, Education and Policy Implications.

The results connected with infection control are significant to the nursing practice, educational process, and healthcare policy. Evidence-based infection control practices must be reinforced in nursing practice by means of constant training and supervision, as well as providing the relevant resources. Infection prevention principles should become part of every part of nursing practice, and nurses should show a professional responsibility in ensuring safe conditions of care.[46]Educationally, infection control has been proposed as a core nursing competency in the nursing curriculum. Undergraduate and postgraduate courses should offer theoretical learning as well as practical skills development, which can be done through simulation based learning. Ongoing professional development initiatives are important to ensure the nurses are informed of the changing guidelines, new infections, and new technology pertaining to infection prevention.[47,48]In policy formulation, the health facilities and regulatory authorities need to establish and implement effective policies on infection control in accordance to the national and international protocols. Adequate staffing, access to personal protection gears, and good monitoring systems should be encouraged by policies. Policies can only be successfully implemented with the help of leadership commitment and a strong safety culture.[49,50]To continue with effective infection control programs, investment in education, infrastructure, and surveillance systems is required. Integrating practice, education, and policy may allow healthcare systems to improve patient safety, lower the rate of infections, and overall nursing care quality.[51,52]

Conclusion

Safe and effective nursing practice is based on infection control, and a major patient safety determinant in healthcare facilities. The study proves that the knowledge and practices of nurses are critical in preventing healthcare-associated infections. Although it is necessary to have enough knowledge of the guidelines of infection control, they are not completely enough to guarantee consistency and efficiency in their practice.The research illuminates continuous learning, training, surveillance systems, and organizational support as some of the factors that can contribute to compliance of nurses with infection control measures. The barriers such as the workload pressures, scarcity of resources and lack of supervision may impede the appropriate implementation. These issues demand an integrated solution, which involves nursing practice, education, and policy formulation.As a way of enhancing compliance, lowering the rate of infection, strengthening of infection control training, enhancing of supervision, and creation of a culture of safety can help improve compliance. Finally, the investments in the education of nurses and the promotion of evidence-based practices of infection control would lead to better patient outcomes, higher quality of healthcare, and safer clinical settings.

References:

1. Ali, M., Wang, W., Chaudhry, N., & Geng, Y. (2017). Hospital waste management in developing countries: A mini review. *Waste Management & Research, 35*(6), 581–592. https://doi.org/10.1177/0734242X17691344
2. Thakur, V., & Ramesh, A. (2017). Healthcare waste disposal strategy selection using grey-AHP approach. *Benchmarking: An International Journal, 24*(2), 470–488. https://doi.org/10.1108/BIJ-06-2015-0059
3. Manzoor, J., & Sharma, M. (2019). Impact of biomedical waste on environment and human health. *Environmental Claims Journal, 31*(4), 311–326. https://doi.org/10.1080/10406026.2019.1619277
4. Akkajit, P., Romin, H., & Assawadithalerd, M. (2020). Assessment of knowledge, attitude, and practice in respect of medical waste management among healthcare workers in clinics. *Journal of Environmental and Public Health, 2020*, 8745472. https://doi.org/10.1155/2020/8745472
5. Hooshmand, S., Kargozar, S., Ghorbani, A., Darroudi, M., Keshavarz, M., Baino, F., & Kim, H. W. (2020). Biomedical waste management by using nanophotocatalysts: The need for new options. *Materials, 13*(16), 3511. https://doi.org/10.3390/ma13163511
6. Patil, P. M., & Bohara, R. A. (2020). Nanoparticles impact in biomedical waste management. *Waste Management & Research, 38*(11), 1189–1203. https://doi.org/10.1177/0734242X20931911
7. Khalid, S., Haq, N., Sabiha, Z. U., Latif, A., Khan, M. A., Iqbal, J., & Yousaf, N. (2021). Current practices of waste management in teaching hospitals and presence of incinerators in densely populated areas. *BMC Public Health, 21*, 1340. https://doi.org/10.1186/s12889-021-11311-1
8. World Health Organization. (2023). *Key facts and figures on health care-associated infections (HAIs): High-level messaging on the HAI and AMR burden*. World Health Organization.
9. Siddiqui, A. H., Umair, R., & Ahmad, J. (2023). Need for infection prevention and control curriculum for nursing in developing countries. *Journal of the Association of Physicians of India, 71*(2), 108–109.
10. World Health Organization. (2024). *Infection prevention and control in-service education and training curriculum*. World Health Organization.
11. Centers for Disease Control and Prevention. (2024). *CDC's core infection prevention and control practices for safe healthcare delivery in all settings*. CDC.

12. Singh, H., Jaiswal, A., Tiwari, R., & Gupta, N. (2024). Harnessing the foundation of biomedical waste management for fostering public health. *Discover Applied Sciences*, *4*, 5735. https://doi.org/10.1007/s42452-024-05735-4
13. Alrubaiee, G., Baharom, A., Shahar, H. K., Daud, S. H., & Basaleem, H. O. (2017). Knowledge and practices of nurses regarding nosocomial infection control measures in private hospitals in Sana'a City, Yemen. *Safety and Health*, *3*, 16. https://doi.org/10.1186/s40886-017-0063-6
14. Desta, M., Ayenew, T., Sitotaw, N., Tegegne, N., Dires, M., & Getie, M. (2018). Knowledge, practice and associated factors of infection prevention among healthcare workers in Debre Markos referral hospital, Northwest Ethiopia. *BMC Health Services Research*, *18*, 465. https://doi.org/10.1186/s12913-018-3277-5
15. Geberemariyam, B. S., Donka, G. M., & Wordofa, B. (2018). Assessment of knowledge and practices of healthcare workers towards infection prevention and associated factors in healthcare facilities of West Arsi District, Southeast Ethiopia: A facility-based cross-sectional study. *Archives of Public Health*, *76*, 69. https://doi.org/10.1186/s13690-018-0314-0
16. Hammerschmidt, J., & Manser, T. (2019). Nurses' knowledge, behaviour and compliance concerning hand hygiene in nursing homes: A cross-sectional mixed-methods study. *BMC Health Services Research*, *19*, 547. https://doi.org/10.1186/s12913-019-4347-x
17. Zhu, S., Kahsay, K. M., & Gui, L. (2019). Knowledge, attitudes and practices related to standard precautions among nurses: A comparative study. *Journal of Clinical Nursing*, *28*(19–20), 3538–3546. https://doi.org/10.1111/jocn.14970
18. Gomarverdi, S., Khatiban, M., Bikmoradi, A., & Soltanian, A. R. (2019). Effects of a multi-component educational intervention on nurses' knowledge and adherence to standard precautions in intensive care units. *Journal of Infection Prevention*, *20*(2), 83–90. https://doi.org/10.1177/1757177418821811
19. Elbilgahy, A. A., Davidson, P. M., & Sharps, P. W. (2019). Evidence-based educational intervention for nurses about prevention of central line associated blood stream infection. *Middle East Journal of Nursing*, *13*(1), 3–16.
20. Acharya, R., Mishra, S. B., Ipsita, S., & Azim, A. (2019). Impact of nursing education on CLABSI rates: An experience from a tertiary care hospital in Eastern India. *Indian Journal of Critical Care Medicine*, *23*(7), 316–319. https://doi.org/10.5005/jp-journals-10071-23192
21. Gupta, R., Sharma, S., Yadav, A., et al. (2020). A multicentric study to ascertain knowledge, attitude and practices for infection prevention and control amongst nurses. *Journal of Patient Safety and Infection Control*, *8*, 21–28.
22. Kakkar, S. K., Bala, M., & Arora, V. (2021). Educating nursing staff regarding infection control practices and assessing its impact on the incidence of hospital-acquired infections. *Journal of Education and Health Promotion*, *10*, 40. https://doi.org/10.4103/jehp.jehp_304_20
23. Maki, G., & Zervos, M. (2021). Health care–acquired infections in low- and middle-income countries and the role of infection prevention and control. *Infectious Disease Clinics of North America*, *35*(4), 827–839. https://doi.org/10.1016/j.idc.2021.07.004
24. Sodhi, K., Arya, M., Chanchalani, G., et al. (2022). Comparison of knowledge and awareness of infection control practices among nurses in India: A cross-sectional survey. *American Journal of Infection Control*, *50*(12), 1368–1373. https://doi.org/10.1016/j.ajic.2022.06.015
25. Thazha, S. K., Cruz, J. P., Alquwez, N., Scaria, B., Rengan, S. S., & Almazan, J. U. (2022). Infection prevention and control awareness, attitudes, and practices among healthcare professionals in South India. *Journal of Infection in Developing Countries*, *16*(4), 659–667. https://doi.org/10.3855/jidc.15528
26. Yu, T., Zhang, X., Wang, Q., Zheng, F., & Wang, L. (2022). Communication openness and nosocomial infection reporting: The mediating role of team cohesion. *BMC Health Services Research*, *22*, 1416. https://doi.org/10.1186/s12913-022-08646-3
27. Prevyzi, E., Patrinos, S., Intas, G., Elefsiniotis, I., Velonakis, E., & Grapsa, E. (2023). Perceptions of teamwork and knowledge attitudes of hemodialysis unit nurses on infection prevention. *Advances in Experimental Medicine and Biology*, *1425*, 555–565. https://doi.org/10.1007/978-3-031-17989-7_56
28. Fitria, N., Yulianita, H., Sugiharto, F., Astari, D. W., & Eriyani, T. (2023). The factors associated with performance among infection prevention and control linked nurses during the COVID-19 pandemic. *SAGE Open Nursing*, *9*, 23779608231193911. https://doi.org/10.1177/23779608231193911
29. Dewi, L., Hamid, A. Y., & Sekarsari, R. (2023). Experiences of infection prevention

and control nurses in performing their roles and duties in the Indonesia Army Central Hospital: A qualitative descriptive study. *Belitung Nursing Journal*, *9*(2), 145–151. https://doi.org/10.33546/bnj.2522

30. Ayed, A., Malak, M. Z., Ayed, M., Allayed, R., & Shouli, M. (2024). Knowledge, attitudes, and practices toward infection control precautions among nurses in Palestinian hospitals. *International Journal of Nursing Education Scholarship*, *21*. https://doi.org/10.1515/ijnes-2023-0074
31. Alshagrawi, S., & Alhodaithy, N. (2024). Risk factors of healthcare-associated infection among healthcare workers in intensive care units: A multicenter cross-sectional study. *PLOS ONE*, *19*(1), e0294037. https://doi.org/10.1371/journal.pone.0294037
32. Elhabashy, S., Moawad, A., & Gaber, S. (2024). Incidence of hospital-acquired infections among healthcare workers in Egypt before and during the COVID-19 pandemic. *Eastern Mediterranean Health Journal*, *30*(9), 612–621. https://doi.org/10.26719/emhj.24.045
33. Au, J. K. L., Suen, L. K. P., & Lam, S. C. (2021). Observational study of compliance with infection control practices among healthcare workers in subsidized and private residential care homes. *BMC Infectious Diseases*, *21*, 75. https://doi.org/10.1186/s12879-021-05777-3
34. Atif, S., Lorcy, A., & Dubé, E. (2019). Healthcare workers' attitudes toward hand hygiene practices: Results of a multicentre qualitative study in Quebec. *Canadian Journal of Infection Control*, *34*(1), 41–48.
35. Browne, K., & Mitchell, B. G. (2023). Multimodal environmental cleaning strategies to prevent healthcare-associated infections. *Antimicrobial Resistance & Infection Control*, *12*, 83. https://doi.org/10.1186/s13756-023-01267-1
36. Centers for Disease Control and Prevention. (2024). *Infection control basics: Standard precautions for all patient care*.
37. Centers for Disease Control and Prevention. (2024). *Infection control basics: Transmission-based precautions*.
38. Gould, D. J., Creedon, S., Jeanes, A., Drey, N. S., Chudleigh, J., & Moralejo, D. (2017). Impact of observing hand hygiene in practice and research: A methodological reconsideration. *Journal of Hospital Infection*, *95*(2), 169–174. https://doi.org/10.1016/j.jhin.2016.11.006
39. Gould, D., Purssell, E., Jeanes, A., Drey, N., Chudleigh, J., & McKnight, J. (2022). The problem with "My Five Moments for Hand Hygiene". *BMJ Quality & Safety*, *31*(4), 322–326. https://doi.org/10.1136/bmjqs-2021-013593
40. Haile, T. G., Engeda, E. H., & Abdo, A. A. (2017). Compliance with standard precautions and associated factors among healthcare workers in Gondar University Comprehensive Specialized Hospital, Northwest Ethiopia. *Journal of Environmental and Public Health*, *2017*, Article 2050635. https://doi.org/10.1155/2017/2050635
41. Ilyas, F., Burbridge, B., & Babyn, P. (2019). Health care-associated infections and the radiology department. *Journal of Medical Imaging and Radiation Sciences*, *50*(4), 596–606.e1. https://doi.org/10.1016/j.jmir.2019.07.003
42. Jimenez, Y. A., & Lewis, S. J. (2023). Infection prevention and control in the medical imaging environment: A scoping review. *Insights into Imaging*, *14*, 121. https://doi.org/10.1186/s13244-023-01447-0
43. Jiang, L., Ng, I. H. L., Hou, Y., Li, D., Tan, L. W. L., Ho, H. J. A., et al. (2018). Infectious disease transmission: Survey of contacts between hospital-based healthcare workers and working adults from the general population. *Journal of Hospital Infection*, *98*(4), 404–411. https://doi.org/10.1016/j.jhin.2018.01.017
44. Lam, S. C., Cheung, M. M. F., Au, J. K. L., & Suen, L. K. P. (2021). Bioluminescence-based hygiene evaluation of public washroom environment. *American Journal of Infection Control*, *49*(6), 746–752. https://doi.org/10.1016/j.ajic.2020.11.013
45. Lau, L. H. W., Lam, Q. S. K., Siu, M. M. Y., Tang, T. S. K., Suen, L. K. P., & Lam, S. C. (2024). Compliance of healthcare workers in a psychiatric inpatient ward to infection control practices during the COVID-19 pandemic. *BMC Infectious Diseases*, *24*, 592. https://doi.org/10.1186/s12879-024-09467-9
46. Lindberg, M., Skytt, B., & Lindberg, M. (2020). Continued wearing of gloves: A risk behaviour in patient care. *Infection Prevention in Practice*, *2*(2), 100091. https://doi.org/10.1016/j.infpip.2020.100091
47. Sands, M., & Aunger, R. (2020). Determinants of hand hygiene compliance among nurses in US hospitals: A formative research study. *PLOS ONE*, *15*(5), e0230573. https://doi.org/10.1371/journal.pone.0230573
48. Smith, J. D., Corace, K. M., MacDonald, T. K., Fabrigar, L. R., Saedi, A., Chaplin, A., et al. (2019). Application of the Theoretical Domains Framework to identify factors that

influence hand hygiene compliance in long-term care. *Journal of Hospital Infection*, *101*(4), 393–398. https://doi.org/10.1016/j.jhin.2018.12.021

49. Stahmeyer, J. T., Lutze, B., von Lengerke, T., Chaberny, I. F., & Krauth, C. (2017). Hand hygiene in intensive care units: A matter of time? *Journal of Hospital Infection*, *95*(4), 338–343. https://doi.org/10.1016/j.jhin.2016.12.004
50. Suleyman, G., Alangaden, G., & Bardossy, A. C. (2018). The role of environmental contamination in the transmission of nosocomial pathogens and healthcare-associated infections. *Current Infectious Disease Reports*, *20*, 12. https://doi.org/10.1007/s11908-018-0611-2
51. Tartari, E., Pires, D., & Pittet, D. (2018). "One size does not fit all": Customizing hand hygiene agents, messages, and interventions. *Journal of Hospital Infection*, *98*(4), 324–327. https://doi.org/10.1016/j.jhin.2018.01.012
52. van Seventer, J. M., & Hochberg, N. S. (2017). Principles of infectious diseases: Transmission, diagnosis, prevention, and control. In *International Encyclopedia of Public Health* (pp. 22–39). Elsevier.