Chapter 1

Patient Safety

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Key Points
• Safe patient care, including infection prevention, is a priority in all health care settings worldwide. • A patient safety culture guides the attitudes, norms, and behaviours of individuals and organisations. • In a safe culture of care, all staff and leaders assume accountability and responsibility for the well-being of patients. • Patient safety requires teamwork and collaboration, communication, continual improvement efforts, measurement, understanding the social aspects of behaviour, and techniques such as human factors engineering.

Introduction

Patient safety is a global health care challenge.[1] Early pioneers in infection prevention and control (IPC) promoted safe patient care through their work. Ignaz Semmelweis reduced maternal mortality through hand hygiene and Florence Nightingale minimised infections in wards during the Crimean war by rigorous environmental cleanliness. Joseph Lister insisted on antisepsis in surgery and reduced surgical site infections. Present-day IPC experts regard healthcare-associated infections (HAI) [sometimes referred to as healthcare-acquired infection – HCAI] as a critical patient safety issue with complications that are very often preventable.[2,3]

Recognising HAIs as a serious problem, the World Health Organization (WHO) Assembly created a World Alliance for Patient Safety to coordinate, spread, and accelerate improvements in patient safety worldwide. The first challenge, launched in 2005, was "Clean Care is Safer Care", which addresses HAIs and improved hand hygiene throughout the world.[4] Subsequently, the WHO has initiated another global and regional issue to address surgical safety: the WHO Second Global Patient Safety Challenge "Safe Surgery Saves Lives". The objective is to define a core set of safety standards to prevent several negative outcomes, one being surgical site infections. The initiative is accompanied by a surgical checklist that is in wide use throughout the world.[5]

Why is there a patient safety problem in health care?

There is a paradox in patient safety. Caregivers continually strive to protect patients and "do no harm", yet the complexity of human illness and frailties of human behaviour often result in errors or adverse events.[6] Even with the most conscientious application of IPC principles and practices, HAIs may still occur from:

Commission (doing something wrong that leads to infection), e.g., using the wrong antiseptic to prepare skin; keeping the urinary catheter bag above the patient's bladder; or selecting the wrong solution from a shelf to irrigate a wound. OR by

Omission (failure to do something right,) e.g., not performing hand hygiene after removing gloves; not examining the catheter insertion site regularly; or not using aseptic technique when inspecting a dressing over a central line insertion site.

Errors such as these may be prevented by leadership providing resources, such as education for the staff and hand washing facilities or hand hygiene supplies, and by care providers who use these resources effectively. Infections formerly thought to be inevitable, such as ventilator-associated pneumonia (VAP), central-line-associated bloodstream infections (CLABSI), and catheter-associated urinary tract infections (CAUTI), can very often be prevented when evidence-based safety practices are applied consistently.[5-7]

A Culture of Patient Safety

A culture of patient safety can greatly enhance infection prevention. Culture has been defined as the deeply rooted assumptions, values, and norms of an organisation that guide the interactions of the members through attitudes, customs, and behaviours.[6-8]

A culture of safety exists when there is a focused organisational effort with commitment from all staff and leaders to keep patients safe from harm. Everyone involved feels accountable and responsible for the safety of the patients and their families, and health care personnel feel safe in speaking out when care is compromised or to report adverse events. To work effectively, IPC professionals must understand their organisation's culture. It is a powerful force that must be addressed when trying to implement or change practices to reduce risk of infection. It is clear that patient safety efforts affect patient outcomes by guiding the behaviour of individuals and the aggregate of persons providing care. See Figure 1.1.

A culture of patient safety involves: leadership, teamwork and collaboration, evidence-based practices, effective communication, human behaviour, learning, measurement, a just culture, systems-thinking, human factors, and zero tolerance.[1]Each topic can be applied to IPC practice and make an important contribution to reducing infection risk.

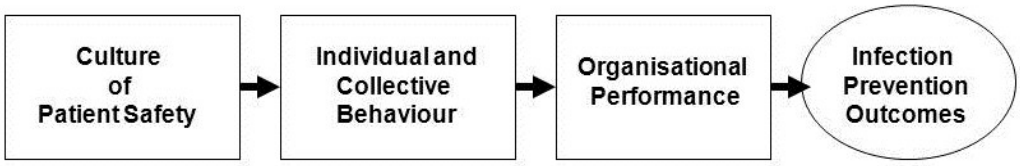

Figure 1.1 A Culture of Safety Affects Infection Outcomes

Patient Safety Principles and Methods Applied to IPC and Risk Reduction for Safer Patient Outcomes

Leadership

Senior leaders are responsible for establishing safety as an organisational priority. They must engage other leaders and staff in the discussion, design, implementation, and sustainability of safety issues. Leaders set the tone by naming safety as a priority, supporting approved behaviours, and motivating staff to achieve the safest care. They must lay down best practices, such as excellent hand hygiene or use of isolation precautions. Leadership is critical to the success of a culture of safety and requires commitment from them and other administrators, physicians, nurses, and others. A study by Saint et al.[9] identified several crucial characteristics of leaders for infection prevention. These characteristics included leaders who:

(1) cultivated a culture of clinical excellence and communicated it to staff;

(2) focused on overcoming barriers and dealing directly with staff or process issues that were barriers to preventing HAI;

(3) inspired their employees to perform at the highest levels;

(4) thought strategically to move initiatives forward and form partnerships across disciplines.[13-14]

Leadership Strategies for IPC professionals

- Engage leaders (formally and informally) throughout the organisation in support of IPC; assist them in increasing the visibility and importance of infection prevention.
- Seek visible, true commitment from senior executives, boards of governance, clinical and support department leaders, and key staff to IPC principles and practices.
- Present a compelling case to leaders that emphasises the decreased morbidity, mortality, and cost when infections are avoided.[10]
- Provide leaders with targeted, valid, and usable information to help them make decisions about infection prevention.
- Assume leadership in the prevention of infections throughout the organisation.

Teamwork and Collaboration

Teamwork and collaboration combine the talents and skills of each member of a team and serve as a check and balance method for care that is integral to patient safety and infection risk reduction.[11] By encouraging the best thinking and incorporating the decisions and actions of each team member, an organisation can enhance care from those closest to the patients. This will help avoid the top-down approach that often interferes with making the best decisions for the patient. Many staff members from various disciplines may be involved in the care of a single patient. These persons may be from different services and functions within the organisation, such as nursing, medicine, IPC, environmental services, and leadership. While multidisciplinary collaboration has proven a very successful approach to help reduce infection risk, care must be taken that multiple care providers work in a coordinated manner to avoid breaches or gaps in care. Strong

collaboration and teamwork help reduce omission or commission errors.[12,13]

Teamwork Strategies for IPC professionals

- Foster collaboration and teamwork by engaging staff as partners in developing IPC policies and procedures as they are the persons who must implement them.
- Encourage a multidisciplinary approach for IPC. Learn about ways to engage persons from different disciplines to work together to develop solutions to complex situations, e.g., how to care for a patient with a central line to reduce risk of infection.
- Participate with teams of caregivers to address infection prevention issues.
- Maintain open communication about infection prevention to include staff and leaders across the organisation.
- Provide performance feedback so staff can evaluate the effectiveness of the intervention(s) and their work.

Effective and Open Communication

Communication is a vital aspect of patient safety. Open communication encourages the sharing of patient, technological, and environmental information. In organisations with a strong patient safety culture, communication is based on mutual trust during the planning and delivery of care and setting goals to achieve best outcomes for patients. Open, transparent communication is necessary for improvement efforts as well as ongoing care.[11]

Communication strategies include the use of written, verbal, or electronic methods for staff education and for sharing IPC data from surveillance, new policies, procedures, and literature studies. Communication on patient safety should include a reporting system that allows staff to raise practice concerns or errors in care without fear of retribution. Often checklists and completion of required consent documents before procedures are used as a form of communication between caregivers.[14,15] Leadership communication about patient safety and IPC has also been found to be influential in promoting patient safety.[16]

Communication Strategies for IPC professionals

- Make routine rounds and discuss patients with infections or those at risk of infection with the direct care providers and listen to staff concerns.
- Share surveillance data and new information.
- Develop a secure system for staff to report infection risks.
- Encourage open discussion about infection risks with leaders and ask them to convey the information to the organisation.
- Use checklists and other documents to help communicate (Also see human factors section).

Evidence-based Practices

A basic element of a safe patient culture is use of evidence-based strategies for care delivery. This requires translating science into practice and standardising practices to achieve the best outcomes. Unfortunately, best practices to prevent infections are not always applied in healthcare organisations. For example, the risk of developing a CAUTI increases with duration of urinary catheter placement. Yet many practitioners fail to remove catheters when they are no longer needed; some physicians even forget that their patient has a urinary catheter.[17]

Evidence-based guidelines for patient care are available from the WHO, the US Centers for Disease Control and Prevention (CDC), the Institute for Healthcare Improvement (IHI), and Evidence-based Practice in Infection Control (EPIC). Some researchers and clinicians propose checklists as a method to help translate evidence into practice.[18] It is important to note that guidelines developed in countries rich with resources often do not translate to low-resource countries. Therefore, each country must analyse how guidelines and evidence from countries with greater resources applies to their unique situation. Then the country can deter-

mine the applicability of the guideline, how it should be adapted, whether implementation is feasible, and if the guideline requirements can be sustained.

The field of implementation science, i.e., translating adoption of best practices from theory or broad scope policy and implementing best practices at the local level, sometimes meets with resistance. Resistance may be due to lack of awareness or information, lack of desire or incentives to change practice, resource constraints or reluctance to change, the culture in the organisation, communication issues, or other factors,[19] or cumbersome methods required to implement new guidelines. Skilled IPC professionals must address these issues to assure that evidence-based practices are used to prevent infections.

Evidence-Based Practice Strategies for IPC professionals

- Continually review new evidence-based literature to determine how it applies to the organisation.
- Learn about the incentives and barriers to adopting and implementing preferred practices within the organisation. Consider also issues external to the organisation in the greater community and how societal culture, training of health professionals and government policies can affect the implementation of evidence-based practices.[20]
- Become skilled in implementation science methodologies (See Further Reading section)
- Address implementation challenges in the planning of new and existing policies and procedures for infection prevention.

Organisational Learning

A learning organisation must support its members so they can learn together, improve their ability to create desired results, embrace new ways of thinking, and transform their environment for better care. An example of learning to think in new ways is the adoption of IPC "bundles" to prevent HAIs due to devices and procedures. Bundles are groups of practices that reduce infections and are carried out by teams of caregivers using the whole bundle for every patient all the time. Also, as related to the social and behavioural aspects of infection prevention, one newer approach to learning is to try to understand persons' mental models regarding their performance.[21] The mental model is a very practical strategy, either real or imagined, to help a person's mind focus on a specific and deliberate activity while freeing up their conscious mind from large quantities of distracting information. Understanding these mental models may help researchers better understand behaviour related to infection prevention processe,s such as hand hygiene compliance.[21]

Using adult learning approaches, such as web-based training, simulation, active participation, and other methods, greatly enhances the staff 's learning, their acceptance of new ideas and helps them incorporate new concepts into their professional behaviour.

Organisational Learning Strategies for IPC professionals

- Share infection information and learned lessons with all appropriate staff.
- Encourage staff to participate in formulating policies and procedures to reduce infection risk; form multidisciplinary teams.
- Use adult learning principles and creative presentations to educate staff.
- Gain organisational commitment for providing learning opportunities and for associated resources.

Measuring Care: Processes and Outcomes

To monitor compliance with patient care practices, to identify gaps in care, and to understand adverse events experienced by patients, IPC staff must collect and report reliable data.[22,23] In a patient safety culture, IPC professionals perform surveillance to monitor infection risks, prevention strategies, and infections. Clinical staff must feel comfortable reporting infections to the IPC team or other persons or groups who would benefit from the information. This may include staff on particular units or departments other

formal groups commissioned within the organisation, and leaders and informal groups of interest.

Staff should measure processes and outcomes to evaluate whether evidence-based care is being provided that can help reduce infections. Examples of process measures might include measurement of hand washing or hand hygiene compliance; consistent implementation of bundle elements, for example, central lines or urinary catheters; or appropriate cleaning of patient environments. The outcome measures, e.g. infections, are also critical to measure, for example, rate of central line or urinary catheter infections or surgical site infections. Many organisations and agencies (CDC, WHO, Health Ministries) throughout the world have promoted or required the reporting of infections to central locations for analysis.

Measurement Strategies for IPC Professionals

- Emphasise the importance of analysing and reporting infections to staff and leaders.
- Educate staff about their role for reporting infections in order to identify gaps in care that can be corrected.
- Use tested infection definitions consistently to identify HAIs.
- Provide a "safe" method for staff to report infections that encourages and rewards rather than blames or punishes reporting. Be clear about the purpose and use for data that are collected. This involves precise definitions of colonisation vs. infection, consistent data collection processes, accurate capture of data, and validation of infection rates. Stratify data whenever possible for more precise analysis, for example, surgical site infections by type of procedure, anaesthesia assessment, and duration of procedure and infections in the newborn population by birthweight (an indirect indicator or risk for infection).
- In collaboration with the clinical and quality staff and others, determine when to maintain or to eliminate specific aspects of surveillance so that measurement is focused and useful.
- Revise risk assessments and develop action plans based on data analysis and timely dissemination of surveillance data.

"Systems" Thinking

Virtually all processes in health care organisations are systems that contain interconnected components, including people, processes, equipment, the environment, and information.[24] In health care organisations, care delivery systems are often cumbersome and poorly designed; they may interfere with, rather than support, safe care.

An example of a system relevant to IPC is administering prophylactic antibiotics for surgery. This seems straightforward, however it is really complex. It involves the pharmacists and pharmacy procedures, patient's families, surgeons, nurses, and anaesthesiologists, together with provision, storage, and transport of the drug and responsibility for dosage and documentation. Late or failed administration of the prophylaxis presents an infection risk.

One study demonstrated the benefits of systems thinking that helped reduce scabies in their organisation.[25] Often errors in care leading to infections for patients are the result of poorly designed or performed systems that prohibit staff from providing the best evidence-based care and can lead to morbidity or mortality for patients or staff. As an example, the Middle East Respiratory Syndrome (MERS) outbreak in the Middle East and the Ebola outbreak in Africa have taken the lives of many health care workers in addition to patients.

Systems Thinking Strategies for IPC professionals

- When designing or updating policies and procedures for staff to follow, consider the entire system, i.e., how the individual parts interact, how one change will affect another, and how the system should work. Include all key stakeholders and test the system with a small pilot study before implementing it organisation-wide.
- Ensure that the system provides for supplies, that staff can successfully perform the assigned

task(s), that the infrastructure supports the desired behaviours, and that coordinating departments support the infection prevention process.

- Work with others to design a system to achieve and sustain success.

Human Behaviour

It has become increasingly apparent that we have little chance to reduce the risk of infections for patients and staff without understanding how humans think and perform. Human behaviour is complex and non-linear, shaped by experiences, values, fears, external and internal pressures, local culture and the socialisation process.[26, 27] One model of human behaviour that has been proposed as holding promise for developing strategies for behaviour change is the ecological perspective. It is based on the premise that behaviour does not occur in isolation but rather resides in an ecological niche and is affected by and affects multiple levels of the social environment. [26]

Another theory proposes that one must consider the embedded core cultural values relevant to patient safety and strategies for change must be compatible with the cultural setting where they are implemented. Therefore, tools that can identify elements strongly compatible with a particular culture may be helpful in this regard.[27] More research is needed in this area to provide guidance for implementing risk reduction strategies that will contribute to patient safety.

Human Behaviour Strategies for IPC Professionals

- Consider change efforts as it relates to organisational culture and human behaviour models.
- Engage staff in change efforts to better understand their values and motivations.
- Use behaviour models when possible to implement change and improvement strategies that will reduce infection risk.

Human Factors Theory

Human factors theory explores how to enhance performance by examining the interface between human behaviour and the elements of a work process, such as the use of specific equipment in the work environment. The objective is to make the work successful by removing barriers and using aids to help make the work easier for staff.

Human factors engineering (HFE) principles have been applied to IPC in recent years and provide optimism as one approach for reducing infections.[28] Human factors engineering helps design or redesign the tools and workplace for best practice. For example, the design of a care process, such as an operation or cleaning a wound, can benefit from using HFE to reduce infection risk. Checklists are used to assure that approved procedures are implemented in a proper sequence and timely manner for surgeries, insertion of central catheters, removal of urinary catheters, and other procedures. Volume-controlled alcohol-based hand rub dispensers placed strategically to make access as easy as possible and safety needles for injections are two examples of human factors applied to reducing infection risks for patients and staff.

Although relying less on human behaviour and more on human factors engineering is promising and proven in many cases,[29] there are often barriers to obtaining acceptance for even some of the simplest changes.[30] One study discusses the use of HFE to analyse compliance with Contact Precautions to care for patients with *Clostridium difficile*. Following nearly 300 observations they concluded that the HFE analysis indicated that the multiple components required to fulfil Contact Precautions procedure requirements acted as a barrier to compliance and should be studied further.[31]

Human factors theory integrates several key principles into an overall philosophy. Table 1.1 describes several of these principles with application to IPC. Table 1.2 describes the challenges of IPC practices with some solutions for overcoming those challenges using human factors applications.

Human Factors Strategies for IPC professionals

- Integrate HFE principles, such as standardisation and checklists, into patient care practices to promote success in reducing infection risk to patients or staff.

- Anticipate potential process failures in IPC strategies and incorporate methods to prevent them, such as visual cues for staff of expected behaviours (i.e., posters and checklists for surgical preparation) or supplies such as safety needles.
- Ensure that individuals performing the work are competent, there is clarity about the task being performed, that the tools and technologies involved work properly, and the environment supports the care process.
- Think about human factors changes as a systemic rather that an individual change.

Positive deviance (noted in Table 1.2) is an approach to behavioural and social change. Positive deviance is based on the observation that there are people whose successful behaviours or strategies enable them to find better solutions to a problem than their colleagues with access to the same resources and challenges. These persons are called positive deviants.

Table 1.1. Selected Human Factors Principles with Application to Designing IPC Practices

Simplify the process: minimise steps and make the process logical and easy to perform, such as having all supplies readily available for a task.

Standardise the process: Standardise equipment and processes, e.g., standardising care of intravascular catheters to prevent bloodstream infections.

Reduce dependence on memory: provide clear written direction, cues, visual aids, and reminders, for items such as preoperative preparation, hand hygiene, isolation precautions, or removal of indwelling devices.

Use forcing functions: make it difficult to do it incorrectly by using equipment like safety needles and needle disposal devices.

Work toward reliability: perform a task correctly and consistently, focusing on how to avoid failure, for example, using aseptic technique to insert a Foley catheter into the bladder.

No Blame – "Just" Culture

Since health care is delivered by humans, some persons will inevitably make errors. When potentially harmful events such as HAIs occur, an organisation can either review the systems of care and learn from the errors, or blame personnel for making them. In a "just" culture (a key component of a patient safe environment) errors are addressed by providing feedback and encouraging productive conversations, and insisting on unbiased, critical analysis of processes to prevent future errors.[32]

Just cultures adopt a "no blame" approach that focuses on the "system" that led to the error rather than on the individual. Blaming staff for errors only creates anxiety and fear and does little to solve current problems or prevent them. Eliminating unwarranted blame is essential for excellence in patient care outcomes. However, a just culture does not mean that purposeful disregard of the rules is allowed. Addressing issues of blaming, and a system's approach is part of a zero tolerance culture and is discussed in the next section. Since the concept and philosophy of a just culture in health care has gained prominence, at least one set of researchers has developed and tested an assessment tool for organisations to use in evaluating the presence of a just culture.[33]

No-Blame, Just Culture Strategies for IPC professionals

- Help maintain a "just", no blame culture by continually focusing on evidence-based practices, epidemiology, and systems rather than "blaming" individuals.
- Use critical thinking to identify and analyse the causes of errors leading to infections so they can be prevented in the future.
- Engage other care-givers in the analysis of errors to share ideas and perspectives

Table 1.2. Human Factors Engineering: Challenges for IPC*

Challenging Principle	Effect	Potential Solutions
Delayed Feedback	• No observable outcome of action from a less than desirable IPC action. • May be observed later by persons who were not involved. • Cause and effect are unclear.	Improve feedback using products that provide information, e.g., • product that glows when hand hygiene inadequate, • environmental markers for cleaning, • volume and use of alcohol-based hand rub for hand hygiene, • electronic badges to monitor hand hygiene.
Lack of Connection with a Positive Outcome for Preventing Infection	• Tangible positive result is not generally apparent to the staff who performed IPC procedure correctly because of time differences. * May reduce motivation to perform correctly again * Intensifies the disconnection between the staff action and the patient outcome • Surveillance data not available "in-time", so not as effective for behaviour change. • Positive deviance not always considered. * • Training does not always provide immediate feedback of positive performance.	• Supplement standard surveillance procedures with data reported monthly, bi-annually or yearly to immediate real-time analysis of each infection identified. This helps staff remember circumstances, can involve more people, provides more immediate feedback for action. • Consider positive deviance-observe successful providers and spread their techniques and methods to other providers. Focus on successful providers, e.g., those who reduce *Clostridium difficile* with presumptive isolation, or redesign the workspace and supplies to enable more prompt isolation. • Simulation training that provides immediate feedback, e.g., how to properly insert a urinary catheter or central line.
Complexity and Inefficiency	• IPC tasks that are not supported with human factors engineering, such as placement of supplies, time to complete the task, or number of steps in a procedure, may delay the process or cause staff to forget it or eliminate it from their practice.	• Reduce complexity and inefficiency with product redesign and human factors considerations. • Examples: infusion pumps that do not allow incorrect settings; antimicrobial stewardship programs requiring approval before administering certain drugs; time-limited orders to remind the provider to take action, e.g., remove urinary catheter; intravenous connectors that do not allow incorrect connections.
Time Pressure and Workload	• When time pressure is in place, other tasks than infection prevention may take priority, provide immediate feedback, and are more connected with positive results. • Cognitive challenge to maintain IPC practice as relevant when no perception of how it is affecting the patient, e.g., microorganism entry into a wound.	Use task observation and analysis to identify process flow and gaps. Examples: • Observe healthcare workers gather supplies for central catheter placement; may demonstrate many steps; bundling helps reduce inefficiency. • Reducing interruptions during central line placement by posting large sign saying Do Not Disturb. • Observing whether more staff or equipment is needed. • Identifying deficiencies in the layout of the room that may predispose to cross-contamination.
Few Infection Prevention and Control Cues to Guide Staff	• Few embedded cues for IPC to indicate to staff when to stop or change procedure, e.g., if central line is placed in wrong location or if antiseptic is applied using incorrect technique or not allowed to dry. • Clues should not disrupt the workflow and lead staff to avoid a task.	• Use of badges or flashing lights to provide a clue to behaviour such as hand hygiene. • Pictures, stickers, colour coding are all examples.
Inconsistent Ergonomic Design for the Work Environment	• Placement of resources used by caregivers to reduce infection risk may be inappropriate, e.g., hand hygiene dispensers inaccessible or absence or lack of hand washing supplies, gowns, or gloves. • Poor visibility, difficulty of access, wrong heights, and separation of tools used in sequence are issues.	• Include and use ergonomic design principles when designing workplace layout, e.g., the placement of alcohol-based hand rub dispensers in visible and accessible locations • Provide signage to indicate location of supplies and store them at reasonable heights in easily accessible locations.
Need Additional Problem Solving Tools for IPC	• Look at broader systems issues when analysing challenges that may allow gaps or breaches of care to occur, e.g., badly designed patient care space, mixing clean and dirty, poor environmental cleaning, lack of appropriate timing of preoperative antimicrobial prophylaxis, or understaffing of caregivers.	• Use effective problem solving techniques that address system issues, e.g., root cause analysis to include the team involved, observations of the workflow and the environment, policies and procedures, training, etc.

*Adapted from: Anderson J, Gosbee LL, Bessesen M, Williams L. Using human factors engineering to improve the effectiveness of infection prevention and control. *Crit Care Med* 2010; 38 (8) Suppl: s269-281.

Zero Tolerance Philosophy

Maintaining a "zero tolerance" approach to patient safety is crucial for safer care.[34] To minimise infections (or errors), leaders must not tolerate non-adherence to proven prevention measures. When "best practices" are known, these should be expected to be performed by all staff whenever possible. If staff disregards safety rules or best practices, such as failing to perform hand hygiene at the appropriate times, handling infectious waste inadequately, or skipping critical steps in cleaning, disinfection or sterilisation, these behaviours should be addressed through informal or if needed, formal mechanisms and not ignored. Infection prevention professionals and leaders should use the available research and proven strategies and adapt them for their context, e.g., what works best in their country or organisation.

High Reliability

The goal, of health care professionals is to avoid as many HAIs as possible in patients and staff. Organisations should strive to attain "high reliability", that is an organisation with consistent performance at high levels of safety over a long period of time. High reliability includes three critical requirements for success: Leadership, A Safety Culture, and Robust Performance Improvement.[36] In addition there are several principles for high reliability that can be applied to infection prevention. See Table 1.3.

Table 1.3. Principles of High Reliability Performance*

Principle	Infection Prevention Examples
Preoccupation with failure	Embracing and learning from failures, such as healthcare-associated infections (HAI).
Reluctance to simplify	Understanding failures by effective analysis and looking at systems rather than blaming individuals, e.g., when infections occur.
Sensitivity to operations	Understanding the work environment and pressures and how this relates to HAIs.
Commitment to resilience	Knowing that errors and infections can be decreased with persistence toward improvement in practice.
Deference to expertise	Including staff at all levels who have expertise in patient care and support services in the design of infection prevention strategies and management.

*Adapted from Weick, Karl, Sutcliffe K. 2007. *Managing the Unexpected: Resilient Performance in the Age of Uncertainty*. 2nd ed. San Francisco: John Wiley &Sons, Inc.

High Reliability Strategies for IPC professionals

- Monitor evidence-based practices for infection prevention, e.g., isolation/precautions procedures, hand hygiene, sterile technique, and cleaning, disinfection and sterilisation.
- Work to improve "broken" or dysfunctional processes of care and defective systems, such as lack of soap and water or alcohol-based hand rub for hand hygiene, personal protective equipment for staff safety, or appropriate ventilation systems.
- Stay up-to-date on evidence-based guidelines as much as possible and integrate them into the infection prevention program.
- Focus less on simply achieving "benchmarks" for infections and working continually toward the "irreducible minimum", e.g., the lowest number of infections that can be achieved in the work situation.
- Do not accept the "status quo" as a long term goal; continually strive to reduce infection rates, acknowledging that this may take time and may present significant challenges.

- Integrate principles of high reliability organisations (HRO) into IPC planning and implementation. (See discussion of High Reliability)

Other infection risks that affect patient safety are described in Table 1.4 together with suggested preventive measures. IPC professionals should consider these measures as they review care processes and make their ward rounds.

What does the future hold for patient safety and IPC?

While contemporary IPC programs have only existed since the 1960s, ancient civilisations and health care leaders worldwide incorporated the principles into patient care for centuries. Today, the basic practices of IPC, including hand hygiene, aseptic technique, and cleaning, disinfection and sterilisation, remain critical to safe patient care. New technology will emerge to help prevent infections, as will highly pathogenic micro-organisms, such as Severe Acute Respiratory Syndrome, Ebola and MERs CoV and the Influenza viruses. These pathogens require prompt attention and a robust, evidence-based response. Medications and therapies will become more sophisticated, and the body of science for IPC will continue to grow and help guide practitioners in their work. Consistent use of basic infection prevention principles and incorporation of new evidence-based care into the culture of patient safety will help to achieve better quality of care for patients and reduce infection risks.

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Table 1.4. Examples of Patient Safety Issues for IPC

Patient Safety Issue	Infection Prevention and Control Example	Potential Solutions
Multiple transfers or patient "hand offs" between staff and services	A patient who is admitted and prepared for surgery is transferred or "handed off" from the admission unit to the nursing staff, the operating theatre staff, post anaesthesia staff, and back to the nursing unit. Inadequate skin preparation, lack of timely administration of prophylactic antibiotics, or poor care of the surgical wound may occur.	• Education about each phase of the surgical process • Clear communication strategies • Monitoring of competence • Reminders, checklists, visual cues • Documentation and analysis of preoperative and postoperative processes of care with feedback to staff
Multiple types of equipment used for patient care	Patients in intensive care, haemodialysis, and other high intensity units often have multiple "lines", fluids, ventilators, dialysers, and other equipment that must all be managed to avoid infection risks. Indwelling urinary or intravascular catheters and ventilators should be removed when no longer needed. Utilities such as water and air can present a risk if malfunctioning.	• Education and training of staff on use of equipment • Competency assessment before performing work • Human factors engineering • Equipment maintenance/cleaning • Environmental assessments
High-risk illness	Patients with immunosuppressive diseases, burns, trauma, and high-risk conditions related to age (neonates, elderly) are prone to infections. They must be carefully assessed and monitored to prevent infections.	• Staff education: observation and reporting criteria • Population-specific criteria • Clear policies and procedures • Careful documentation, monitoring, and feedback to staff about infections
Time pressure	High intensity environments commonly have large workloads and limited time to complete essential infection prevention tasks. For example, staff often indicate that they are "too busy" to wash hands or perform hand hygiene when appropriate.	• Time management support; evaluation of workload, staffing, and assignments • Work environment design (human factors engineering), such as for hand hygiene availability and location of water, sink design and location, alcohol-based solutions to decrease hand hygiene time
High-risk procedures/medications	Patients are at increased risk of unsafe care and infection during some procedures and with some medications. For example, the lack of preoperative antibiotics at the correct time and with the correct dose or discontinuation at the recommended time can fail to reduce risk of surgical site infections.	• Develop clear protocols and processes for administration of preoperative antibiotics • Educate staff about the procedures • Assign responsibilities • Monitor compliance with processes and report outcomes • Implement performance improvement initiatives when appropriate
Distractions and multitasking	Distractions during delivery of care or attempting to perform many tasks simultaneously can lead to errors. Staff may omit hand hygiene because of distractions during busy times. Staff using aseptic or sterile techniques may contaminate the area because of distractions.	• Provide work environment with few distractions • Initiate culture of quiet and lack of interruption • Use visual signs to indicate no interruptions • Encourage one task at a time • Include staff in making decisions about work flow and environment • Provide cues to remind staff of steps in an activity
Inexperienced or incompetent care givers	Inexperience or lack of competence in healthcare personnel may lead to bad practice. For example, personnel who insert intravascular catheters and are not competent to use recommended sites, such as the subclavian vein, may choose the femoral vein for insertion with its associated higher infection risk.	• Analyse why staff are inexperienced • Provide orientation / training for all staff who insert intravascular catheters, including rationale and supervised practice until competency is established • Periodically monitor skills and provide feedback

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