Chapter 3

CRITICAL CARE NURSING'S ROLE IN PREVENTION OF HARM: GOING BACK TO THE FUNDAMENTAL NURSING CARE WITH EVIDENCE

JoAnne Phillips
DNP, RN, CNS, CCRN, CPPS, NEA-BC, FCNS

Kathleen Vollman
MSN, RN, CCNS, FCCM, FCNS, FAAN

Jessica Schmidt
MSN, RN, AGCNS-BC, PCCN

LEARNING OUTCOMES

After completing this e-chapter you will be able to:

1. Explain the role of missed nursing care in creating potentially preventable harm in acute and critical care.
2. Describe how "Sustaining Successful Integration of Fundamental Care Framework" helps to ensure reintroduction and valuing of evidence based fundamental nursing care in conjunction with the right resources and systems to sustain practice.
3. Identify various evidence-based strategies to reduce pressure, shear, friction and moisture injuries for patients in intensive care.
4. Identify the core components of the World Health Organization (WHO) Infection Prevention and Control Program.
5. Define the components of the WHO multimodal hand hygiene improvement strategy.
6. Define the key components of the care bundles designed to prevent central line associated blood stream infections, catheter associated urinary tract infections, and ventilator associated pneumonia.
7. Describe the physiologic impact of immobility on the musculoskeletal, respiratory and cardiovascular systems.
8. Describe the pathophysiology and management of ICU acquired weakness and the impact on short- and long-term outcomes for critically ill patients.
9. Describe the early progressive mobility protocol from AACN and the potential impact on outcomes

Chapter Overview

In today's intensive care setting, nurses are charged with the demanding responsibility of delivering compassionate, technologically advanced, and highly complex care—while ensuring no harm comes to the patient. Creating a culture of safety requires a close examination of daily practices and systems to recognize risks and minimize the possibility of error. This chapter explores the gaps that persist in the delivery of fundamental nursing care, harm that occurs and introduces the Fundamentals of Care Framework for organizing essential nursing care practices into three areas. To achieve lasting improvement, change strategies must be implemented that not only reestablish the value of evidence-based basic care but also align it with appropriate resources and sustainable systems. Critical care nurses are uniquely positioned to reduce preventable harm in several key areas, including the prevention of skin breakdown, healthcare-associated infections (HAIs), deconditioning, and cognitive decline. Although this list is not exhaustive, consistent use of assessment skills and evidence-based interventions allows nurses to profoundly influence both immediate recovery and long-term outcomes for critically ill patients.

The Impact of Harm and the Economic Burden

The landmark Institute of Medicine (IOM) report *To Err is Human* (1999) defined patient safety as the avoidance of harm during care and called for a shift toward systems that anticipate errors, foster learning, and establish safety as a cultural norm. Yet, even after two decades of progress, preventable harm remains a persistent problem. Around the world, one in every ten patients are harmed in healthcare and more than three million deaths occur annually related to unsafe care. (Slawomirski & Klazinga, 2020). In a recent meta-analysis Panagioti et al. (2019) found that 50% of the harm occurring in healthcare is preventable. Globally indirect cost of patient's harm amounts to trillions of US dollars. Don Berwick (2023), founding president of the Institute for Healthcare Improvement, has cautioned that momentum in the patient safety movement has slowed, emphasizing the urgent need to revisit system-level strategies. Recent evidence underscores the concern (Bates et al., 2023). Common causes of potentially preventable harm include healthcare-associated infections, missed nursing care, falls, and pressure injuries, all of which worsen patient morbidity, increase mortality risk, and raise costs. Preventable harm typically arises from identifiable risks that can be addressed through proactive safety strategies. By embedding evidence-based guidelines and system-level supports, recurrence of adverse events can be significantly reduced (Panagioti et al., 2019). Padula and Pronovost (2024) introduced the concept of "defects in value," estimating that $35 billion of the $48 billion spent annually on hospital-acquired harm could be avoided through investment in prevention. Research consistently shows that patients who suffer an adverse event stay longer in the hospital and generate higher costs compared to those with uncomplicated care episodes (Miller et al., 2024). Standardized fundamental nursing interventions targeting pressure injury prevention, infection control, mobility and oral hygiene have repeatedly proven more cost-effective than treating complications after they occur (Connor et al., 2023; Bates et al., 2023).

Missed Nursing Care

Missed nursing care—defined as care that is delayed, left incomplete, or omitted—is strongly associated with harm, including HAIs, pneumonia, pressure injuries, delirium, and prolonged recovery (Hessel et al., 2019). Chaboyer et al., (2021) identified four main categories of missed care: essential physical care, communication and handoff processes, patient self-management support, and emotional/psychological needs. Importantly, hospitals with stronger cultures of safety—where teamwork, transparency, and non-punitive reporting are valued—report lower levels of missed care (Alanazi et al., 2023).

Studies reveal that fundamental tasks such as repositioning, feeding, and oral hygiene account for nearly three-quarters of missed interventions (Kalisch et al., 2014; Hessel et al., 2019). Drivers include staff shortages, increasing patient acuity, inadequate resources, and competing urgent clinical priorities (Gong et al., 2025). When care is rationed due to time or staffing constraints, both patient safety and trust are undermined (Piotrowska et al., 2022; Witczak et al., 2021). System-level commitments—safe staffing, adequate resources, and prioritization of prevention over reaction—are required for progress, though difficult under current financial models.

Evidence-Based Nursing Practice and Outcomes

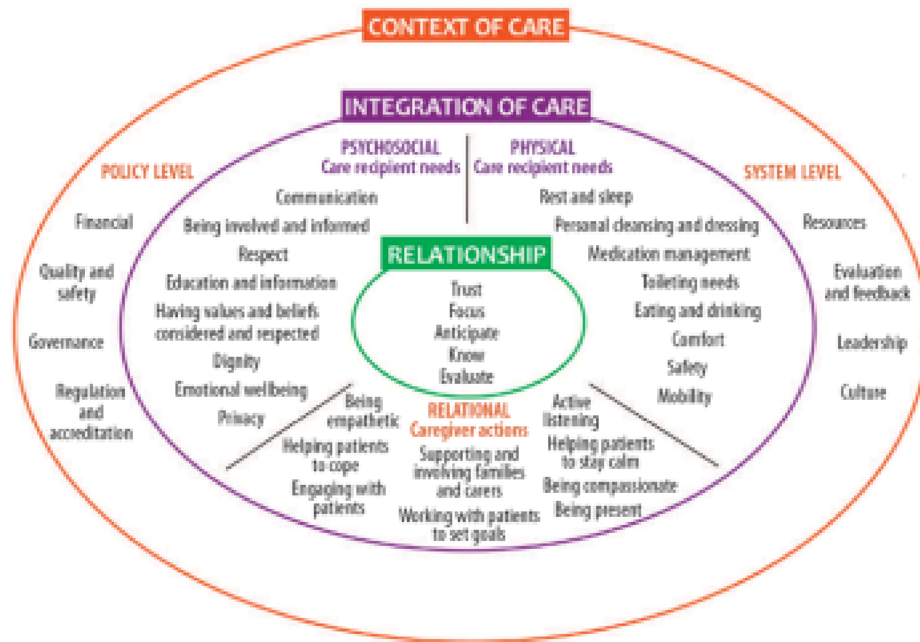
When nurses can provide evidence-based care, data show that it improves patient outcomes. Harms such as falls, pressure injuries, immobility complications, and infections are recognized as nurse-sensitive outcomes. A scoping review by Connor et al. (2023) showed that evidence-based practice (EBP) interventions not only reduce harm but also shorten length of stay and improve survival, with nearly all economic analyses demonstrating a positive return on investment.

Common approaches include care bundles, clinical protocols, and product standardization. Still, gaps remain. A 2025 systematic review by McEvoy et al. noted that while harm reduction outcomes are well-studied, nurse-sensitive metrics such as functional status, unplanned extubations, and family satisfaction are less consistently measured. Curley et al. (2022) called for reframing from simply documenting harm to actively demonstrating safety. For example, instead of reporting rates of pressure injury, they propose measuring the proportion of at-risk patients who remain injury-free.

Securing Successful Integration of Fundamental Nursing Care

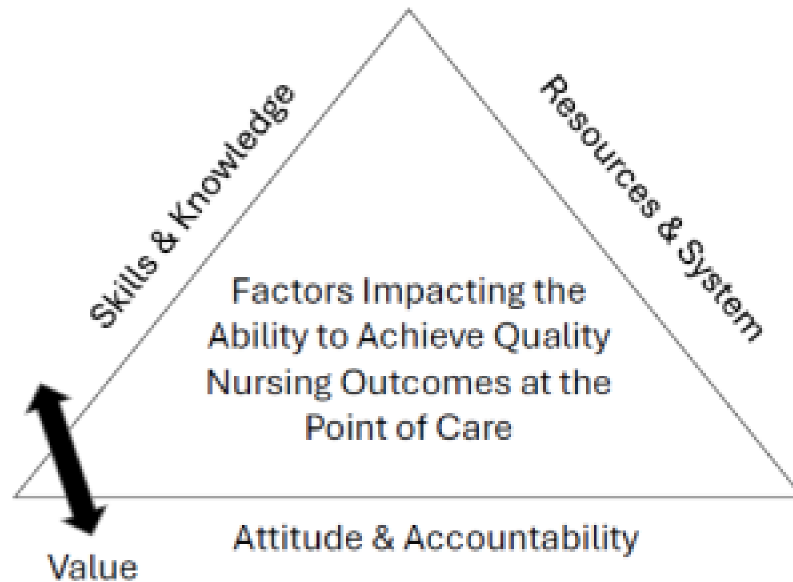
Sustainable safety improvements require more than teaching EBP principles. If foundational nursing practices—such as positioning, mobility, hygiene, patient teaching and relational trust—are undervalued, improvement efforts fail to take hold. Kitson’s Fundamentals of Care framework (2013) highlights the integration of physical, psychosocial, and relational needs in the care process (Figure 1). Use of a model may help clarify and provide a means to articulate nursing’s unique contributions to healthcare.

Figure 1: The Fundamentals of Care Framework. Note: Adapted from The Fundamentals of Care Framework, by The International Learning Collaborative (https://ilccare.org/the-framework/). Reprinted with permission.



Success in nursing's journey will be fleeting if the fundamentals are reintroduced as the basic care nurses have been performing for years or initiated as a process followed by audits alone. Instead, successful transformation begins with developing a culture that values the importance of these care practices and the evidence that supports them. While providing evidence-based education, frequent motivational reminders may be inserted that reinforce the understanding that fundamental/basic care practices are core to the profession of nursing, are independent in scope and if not performed or delegated by us, may cause patient harm. This is authentic patient advocacy (Vollman, 2013). However, patient advocacy by nurses is often articulated and performed within a narrow window of a single incidence where the nurse serves as the voice for the patient to ensure "the right thing happens" and/or application of evidence-based care. Nurse advocacy must reach beyond that view to encompass preventing harm within the context of all clinical practice. To achieve this change, education is not enough. Numerous studies have shown that education/skill building is not enough to affect sustainable change (Gifford et al., 2014 & Lenzer 2015). Multimodal strategies that evaluate the available nursing resources and systems in order to effect change, make it easier for the clinician to achieve an effective and consistent practice. Such initiatives have shown greater success (Cassidy et al., 2021). True sustainability comes from aligning education with systems that simplify, standardize, and support best practice (Cafazzo, 2012). Once those systems are in place, accountability can drive consistent delivery of safe care (Vollman, 2013) (Figure 2).

Figure 2 Sustaining Successful Integration of Fundamental Care Adapted with permission from Vollman KM. Interventional patient hygiene: discussion of the issues and a proposed model for implementation of the nursing care basics. Intensive Crit Care Nurs. 2013;29(5):250-255.



When frontline staff are empowered to focus on prevention, the evidence is clear: preventing harm is less costly than treating complications. In the following sections we will be addressing nursing care practices that are independently owned that have an impact on skin, infections and preventing the complications of immobility. These include pressure injury prevention, hand hygiene, bathing, oral care, and early mobility.

Practice Question

1. What percentage of global harm in healthcare is likely preventable?
   a. 15%
   b. 25%
   c. 50%
   d. 75%
2. Professional practice flourishes in an environment that is structurally empowered due to:
   a.Innovative leadership
   b. Evidence-based structures
   c. Evidence-based processes
   d. All of the above
3. The Fundamentals of Care Framework was designed to

a. Provide additional tasks for nurses to complete

b. Strengthen the connection between nursing care & outcomes

c. Outline a structure to measure the impact of medical care

d. Demonstrate a link between infection and hand hygiene

Answers: 1. c 2. d 3. b

Fundamental Nursing Care Practices for Patients at Risk for Skin Injuries

The National Pressure Ulcer Advisory Panel (2025) defines a pressure injury as localized skin or tissue damage due to pressure, pressure in combination with shear, or medical or other devices and is classified into stage one through four, unstageable, or deep tissue injury. Pressure injuries are a preventable medical error. Approximately two to three million individuals in the United States develop a hospital-acquired pressure injury (HAPI) each year (Padula & Delarmente, 2018; Mervis & Phillips, 2019). The prevalence rate for HAPIs ranges from 6.4 to 32.7% globally (Walker et al., 2020; Mervis & Phillips, 2019; Chaboyer et al., 2018). In one prevalence study across 90 countries, there was an overall pressure injury prevalence of 26.6% adult patients (Labeau et al., 2021). The individual cost of a pressure injury ranges from $12,000- $41,000 US (Alderden, Shibily, Cowan, 2020). Pressure injuries are estimated to cost the United States $11 billion, the United Kingdom £750 million, the Netherlands $2.8 billion, and Australia $1.8 billion annually (Chaboyer et al., 2018). Critically ill patients are at a higher risk for HAPIs. Pressure injuries occur in 6 to 10% of critically ill patients and are twice as common compared to patients in medical-surgical units (Alderden, Shibily, Cowan, 2020). This preventable event can progress to extensive harm, contributing to 60,000 annual deaths (Padula & Delarmente, 2018).

Pressure injury prevention poses a significant challenge for nurses in the critical care setting. To prevent pressure injuries, nurses must understand pressure injury prevention, implement evidence-based interventions that are individualized to a patients' need and engage a multidisciplinary team for prevention efforts (Alshahrani, Sim, & Middleton, 2021).

At Risk Population

Pressure injuries occur from sustained pressure over bony prominences, leading to tissue ischemia and necrosis, shear and friction affecting capillary beds and contributing to local tissue hypoxia, excessive moisture leading to maceration and skin breakdown, and sustained pressure from medical devices (Mervis & Phillips, 2019). Patients at the highest risk for skin injury include the elderly, neonates and children, neurological impairments, malnourished, impaired mobility or sensation, bed or wheelchair-bound, and patients in low perfusion states (Mervis & Phillips, 2019; National Pressure Injury Advisory Panel, 2025).

***Table 1**. Medical Conditions with Increased Risk for Pressure Injury Development*

(Mervis & Phillips, 2019; European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019; Alderden et al., 2020).

Medical Conditions with Increased Risk for Pressure Injury Development
• Diabetes • Obesity • Deep Vein Thrombosis • Renal Failure • Vascular Disease • Rheumatoid Arthritis • Cognitive Impairment • Congestive Heart Failure

One study concluded that patients with darker skin tones had a higher incidence of pressure injuries than patients with light skin tones, this places patients with darker skin tones at a higher risk for pressure injury development and should be considered when conducting a risk assessment (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019). Patients with darker skin tones are more likely to have higher stage pressure injury stemming from inappropriate identification of stage 1 pressure injury damage (Oozageer Gunowa et al., 2017). Additional research is necessary to explore the relationship between pressure injuries and darker skin tones. Patients who are critically ill and in the intensive care unit have a greater risk of medical-device related pressure injuries than non-intensive care patients (Chen et al., 2024). Research shows that medical-device related pressure injuries occur an average of three days sooner than pressure injuries from other etiologies (Delmore & Ayello, 2023). Nurses must assess the skin under and around the medical devices for signs of pressure related injuries as a part of the routine skin assessment (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance 2019).

In the critically ill population, it is imperative to consider altered perfusion as a pressure injury risk. Inadequate perfusion leads to tissue hypoxia and increases the risk for pressure injury development (Alderden et al., 2020). Vasopressor use and respiratory compromise also contribute to inadequate perfusion, which is commonly seen in critically ill patients (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance 2019). One study found that patients who received norepinephrine were three times as likely to have a pressure injury develop during their stay (Cox, Schallom, & Jung, 2020).

Nutrition plays a pivotal role in pressure injury prevention and risk. Critically ill patients have a higher prevalence of malnutrition, ranging from 38 to 78% (Munoz et al., 2022). Insufficient nutritional intake, low body weight, and obesity are associated with impaired wound healing (Munoz et al., 2020). Nutritional screening is recommended for all patients who are at risk for pressure injury development (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2025). Screening should occur within 24 hours of admission and after significant change in the individual's clinical condition and the patient assessed by a registered dietitian nutritionist for further assessment (Munoz et al., 2020; European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2025).

Assessing Risk

Risk assessment tools aid healthcare professionals to identify patients who are at-risk for pressure injury development (Gaspar et al., 2022). The most common risk assessment tools include the Braden Scale for Predicting Pressure Sore Risk, Norton Scale, and Waterlow Score. Studies have shown that it is more beneficial to base clinical decision making on scale sub scores over total scores (Gaspar et al., 2022; European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019; Alderden et al., 2020). It is recommended to complete daily risk assessments and implement evidence-based strategies based on the patients inherent risk of pressure injury development (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019). The risk assessment tools provide a practical framework, modifiable risk factors that can be addressed, sub scores for individualized planning, and reminders for bedside staff on appropriate interventions (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019). Although an adjunct for care, risk assessment tools must always be used in conjunction with clinical judgement (Kandi et al., 2022).

General Skin Care

Nurses must inspect the skin as soon as possible after an admission or transfer to the receiving unit, with every risk assessment, as the patient's risk level changes, and prior to discharge (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019). A head-to-toe skin assessment, in addition to individualized focused skin assessment for high-risk individuals, should assess bony prominences, skin folds, and under medical devices is essential (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance 2019). The skin assessment should include a visual and tactile assessment, assessing skin temperature and texture (Alderden et al., 2020). It is recommended to have adequate lighting and moisturize darker pigmented skin to improve visualization for assessment (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019). Increased body temperature can increase the risk of pressure injury development (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019). General skin care includes keeping the skin clean and appropriately hydrated, cleaning the skin promptly after incontinence, utilizing a cleanser that is pH balanced for the skin

(pH of 5.5) and protecting the skin from excessive moisture with a skin barrier product (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019). Studies have shown a decrease in erythema and broken skin with a pH-balanced (pH 5.5) product, compared to traditional soap (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019). The healthcare team should avoid excessive rubbing of the skin and minimize the layers between the patient and the support surface that could lead to damage due to friction (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019; Roufogalis & Hutchinson, 2020). Moist or wet skin is more susceptible to damage, risk for infection or skin injury/breakdown (Roufogalis & Hutchinson, 2020). The healthcare team should use high absorbency incontinence products to protect the skin of the individuals with or at risk of pressure injuries who have urinary incontinence (European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019).

Interventions to prevent pressure injury development include pressure injury prevention bundle with evidence-based strategies. Prevention bundles have been shown to decrease the incidence of pressure injuries (Alshahrani et al., 2020). Common interventions include ongoing skin and risk assessments, skin hygiene, heel elevation, repositioning and nutritional assessment, progressive mobility protocols, support surface selection, and preventative dressings to bony prominences (Alshahrani et al., 2020). The correct support surface selection has the potential to reduce pressure injuries; powered active air surfaces and powered hybrid air surfaces reduce the incidence of pressure injuries by 58 to 78%, compared to traditional mattresses (Shi, Dumville, Cullum, 2018). Table two outlines evidence-based strategies to implement for pressure injury prevention.

Pressure injuries are preventable, but require a comprehensive, team-based approach with individualized interventions. Utilizing a prevention bundle focusing on thorough assessment and intervention implementation, prevalence of pressure injuries can be minimized in the critical care setting. *A*nother key area of injury prevention relates to infection prevention.

Table 2. *Evidence-Based Strategies for Pressure Injury Prevention*

Evidence-Based Strategies for Pressure Injury Prevention
Assessment • Assess for significant current or anticipated mobility problems • Utilize a structured risk assessment tool • Reassess risk every shift and with any significant clinical change • Assess skin upon admission, every shift, and with significant clinical change • Assessment must be comprehensive, with visual and palpable assessments for erythema, discoloration, edema, temperature • Assess under all medical devices • For darker skin tones, ensure adequate lighting and skin moisture for visual inspection

Nutrition ● Conduct a nutritional screening with a simple, valid tool for individuals at risk for pressure injury ● Conduct a comprehensive nutritional assessment for adults at risk for pressure injury ● Develop and implement an individualized nutrition care plan for individuals with, or at risk of a pressure injury ● Refer individuals at risk to a registered dietitian ● Optimize energy intake for individuals at risk, encourage a balanced diet with nutrient dense food and adequate hydration ● Adjust protein intake for individuals at risk; protein intake should be 1.2 to 1.5g/kg body weight/day for older adults and 1.2-2.0/kg for adults in critical care ● Nutritional supplements for individuals at risk of pressure injuries who are malnourished or risk of malnutrition when nutritional needs are not met by dietary intake
Positioning ● Reposition all individuals with or at risk of pressure injuries on an individualized schedule ● Ensure self-repositioning is effective and adequately off-loading bony prominences ● Reposition the individual in such a way that optimal offloading of all bony prominences and maximum redistribution of pressure is achieved ● For patients who are sedated and ventilated, frequently reposition the head ● Use moving and handling equipment to reposition; avoid dragging to reduce friction and shear (pay particular attention to the individual's heels during transfer) ● Assess for signs of early skin and tissue injury, the individual may require more frequent repositioning ● Use 30-degree side lying positions, avoid 90-degree side lying positions ● When elevated the head of bed, maintain elevations at 30 degrees of lower to minimize soft tissue deformation ● Limit time spent sitting out of bed for individuals at high risk ● Encourage individuals in the seated position to implement weight shifts and pressure relief maneuvers ● Do not use ring or donut-shaped devices in the seated position, the edges create areas of high pressure and may damage tissue ● Implement an early mobilization program that increased activity and mobility as rapidly as tolerated ● For unstable critically ill individuals, initiate frequent small shifts in body position, who are too unstable to maintain a regular repositioning schedule ● Small weight redistributions, passive range of motion, repositioning the extremities, head rotation, heel elevation and tilting the body to lower angles ● For individuals at risk of heel pressure injuries, elevate the heels using specifically designed heel suspension device or a pillow/foam cushion ● Regularly monitor the tension of medical device securement and where possible seek the individual's self-assessment of comfort ● Regularly rotate or reposition the medical device and/or the individual

Support Surfaces

- Use a prophylactic dressing as an adjunct to heel offloading and other strategies to prevent heel pressure injuries
- Use a prophylactic dressing beneath a medical device to reduce the risk of medical device related pressure injures
- Use a soft silicone multi-layered foam dressing to protect the skin for individuals at risk
    - o Assess the skin under a prophylactic dressing at least daily
- Select a support surface that meets the individual's need for pressure redistribution based on the following: level of mobility, need to influence microclimate control and shear reduction, size and weight of the individual, number, severity, and location of existing pressure injuries and risk for developing new pressure injuries
- Use a high specification reactive single layer foam mattress or overlay in preference to a foam mattress without high specification qualities
- Avoid multiple linen layers under the individual
- Consider using a reactive air mattress or overlay for individuals at risk
- Assess the relative benefits of using an alternating pressure air mattress or overlay for individuals at risk
- Use a pressure redistribution cushion for preventing pressure injuries in people at high risk who are seated in a chair/wheelchair for prolonged periods
- For individuals with or at risk, consider using a pressure redistributing support surface during transit
- Check that no objects or medical devices are underneath the individual
- Ensure that the full support surface is sufficiently wide to allow the individual to safely turn/be repositioned from one side to the other
- Ensure there is adequate clearance between the individual and bed rails/sides to avoid device related pressure injuries

(Standardized Pressure Injury Prevention Protocol from the National Pressure Injury Panel, 2024, European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2019; European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance, 2025).

Practice Questions

1. What strategy is recommended to improve visualization of pressure injuries in patients with darker skin tones?
    a. Use ultraviolet light and magnification
    b. Apply skin dyes to highlight affected areas
    c. Moisten the skin and ensure adequate lighting
    d. Rely solely on tactile assessment
2. True or False: It is acceptable to perform frequent small weight distribution for unstable critically ill individuals
    a. True
    b. False
3. Which of the following is a recommended protein intake for older adults at risk of pressure injuries?
    a. 0.8 g/kg body weight/day
    b. 1.2 to 1.5 g/kg body weight/day
    c. 2.0 to 2.5 g/kg body weight/day
    d. 1.0 g/kg body weight/day

Answers: 1. c; 2. a; 3. b

Healthcare Acquired Infections: International Overview

Healthcare-associated infections (HAIs) are the most frequently occurring adverse events in healthcare (WHO, 2024). Over the past decades, the world has experienced the spread of potentially deadly pathogens, including Middle East respiratory syndrome (MERS-CoV), Ebola, SARS-CoV-2, Marburg Virus Disease, and Monkey Pox. These outbreaks have demonstrated significant gaps in the infection control and prevention programs globally. International organizations with standards for infection prevention and control include the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), and the European Center for Disease Prevention and Control (ECDC). According to the Organization for Economic Co-operation and Development (OECD) and the World Health Organization (WHO), the annual loss of life due to HAIs is predicted to be 3.5 million per year until 2050 (WHO, 2024). There are three core objectives in the global strategy on infection prevention and control developed by the WHO. First, prevent infection, which may sound simplistic but as yet, has still not been achieved. Second, ensure infection control and prevention programs based on the WHO infection prevention and control (IPC) core components are in place to prevent HAIs and reduce antimicrobial resistance. These components include leadership engagement, stakeholder support, and financial and legal resources. The third objective is to coordinate infection prevention and control activities with other health care priorities, including antimicrobial resistance and WASH (water, sanitation, and hygiene) (WHO, 2024).

Healthcare Acquired Infections: Prevalence

The WHO has identified a relationship between income and the prevalence of HAIs. Fifteen out of one hundred hospitalized patients in low-middle income countries will develop a HAI, while only seven out of every one hundred hospitalized patients in high income countries will develop a HAI. In the European Economic Area, which includes the European Union, Iceland, Liechtenstein, and Norway, the prevalence of HAIs in hospitalized patients is eight out of one hundred. Overall, the Western Pacific areas and Americas have lowest HAI prevalence; the African nations have the highest prevalence (Batran et al., 2025). The key pathogens associated with HAI include bacteria (Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa), viruses (norovirus, influenza), and fungi (candida species) (Hill, Lamichhane & Wamburu, 2024).

Healthcare-Associated Infections: Consequences

HAI can lead to increased length of stay, increased cost, long term medical complications, disability and death. Among hospitalized patients, HAIs are seen more predominantly in critical care units, potentially related to the number of indwelling devices and invasive procedures patients experience. Patients that develop sepsis and multi-organ failure in critical care have a mortality rate over fifty percent (Batran et al., 2025).

Infection Prevention and Control Programs

The Joint Commission on Accreditation (TJC) is an accrediting organization that certifies 22,000 healthcare organizations / 5000 hospitals globally in quality and safety standards. In 2004, TJC and The Joint Commission International (TJCI) introduced a National Patient Safety Goal (NPSG) that required organizations to comply with the Centers for Disease Control (CDC) or the WHO hand hygiene guidelines. Hand hygiene foundational to prevent healthcare-associated infections through transmission of pathogens on the hands of healthcare providers (TJC, 2025; TJCI, 2025). In 2006, the NPSG was updated to include a requirement to "manage as sentinel events all identified cases of unanticipated death or major permanent loss of function associated with a healthcare-associated infection" (Geller & Guzman, 2005, p. 2). Additional requirements were added in 2009 to implement evidence-based practices to prevent infections due to MDRO (multi-drug-resistant organisms) infections, CLABSIs (central line associated blood stream infections), catheter associated urinary tract infections (CAUTI) and a surveillance system for HAIs (TJC, 2008). Evidence base practice guidelines to prevent ventilator associated pneumonia were added in 2012. By 2021, the NPSG was again modified to require only hand hygiene using the CDC or WHO standards.

Infection prevention and control programs are the "foundation for reducing endemic HAI and spread of antimicrobial resistance" (Tomczyk et al., 2022 p. 845). In many organizations, the authority and responsibility for infection prevention and control programs rests with the Infection Control Committee, which may include an epidemiologist (physician with expertise in infection control), an administrative director, infection preventionist, data programmer and analyst, administrative assistant, and environmental health specialist (Dhar et al., 2021). Not all organizations have the resources to establish such a complex IPC program. An effective IPC program can predictively prevent up to 50% of HAIs (Hill, Lamichhane & Wamburu, 2024; Tomczyk et al., 2022), with a focus on achieving zero HAI (Dhar et al., 2021).

Effectiveness of IPC Programs

In 2019, the WHO conducted a global, cross-sectional survey among healthcare facilities to measure the effectiveness of IPC programs, using the Infection Prevention and Control Assessment Framework (IPCAF) and the Hand Hygiene Assessment Framework (HHAF). The results of the survey demonstrated that 50% of the facilities had an advanced level of IPC programs; 29.8% had intermediate level programs; 17.5% had basic programs; two percent had inadequate programs. The lower scores occurred in low-middle income countries. The core components of the WHO IPC include guidelines, education, HAI surveillance, multimodal strategies, monitoring and auditing of infection prevention and control practices, workload, staffing and bed occupancy, and auditing environment and materials for infection control and prevention (Arvidsson, Lindberg, & Skytt, 2025; Tomczyk et al., 2022).

Evidence Based Practice: Infection Prevention

Evidence base practice is fundamental to mitigating the risk of HAI (Hill, Lamichhane & Wamburu, 2024). Certain populations are at higher risk of developing HAIs, including age extremes, immunosuppression, invasive procedures, hospital length of stay, and work environment (Arvidsson, Lindberg, & Skytt, 2025). Evidence based practice interventions to prevent HAIs are included in table three. One of the key evidence based practices recommended is the implementation of bundles. Bundles are small sets of evidence based practices that when implemented together, improve outcomes (Resar, Griffin, Haraden, & Nolan, 2012). Three different care bundles, designed to prevent central line associated blood stream infections (CLABSIs), catheter associated urinary tract infections (CAUTIs), and ventilator associated pneumonia (VAP) are presented in table four. The elements for each bundle should allow for local customization. Column three expands on the simple elements of the bundles. Chlorhexidine bathing is an essential evidence based practice to prevent HAI.

Table 3: *Infection Prevention: Evidence Based Practice Interventions*

Infection Prevention: Evidence Based Practice Interventions	
Hand hygiene	
Compliance barriers: · High workload · Skin irritation · Lack of access to proper equipment · Lack of real time feedback	**WHO 5 moments of Hand Hygiene** **Soap and water** · Hands visibly soiled · Known or suspected exposure to spores, infectious diarrhea **Alcohol based hand sanitizer** · Before and after contact with patient · Moving from soiled body site to clean body site · After contact with potentially contaminated surfaces · Before performing aseptic tasks · After contact with blood, body fluids, or contaminated surfaces · Supplies and equipment should be easily available **Before and after donning gloves** **After touching a pt or the immediate environment Nails:** · One quarter inch long · Avoid artificial nails / extenders / artificial nails
Personal Protective Equipment	
Compliance barriers: · Availability of equipment and supplies · Education and knowledge	Proper donning and doffing Patient assessment and other PPE Barriers: improper D&D due to lack of education Types of Infection precautions · **Airborne:** known or suspected illnesses transmitted by airborne droplet nuclei; N-95 or higher · **Droplet**: known or suspected illnesses transmitted by large particle droplets; face mask · **Contact:** known or suspected illnesses transmitted by direct contact with patient or environment; private room
Sterile Technique	

Consistent use of sterile technique	Maintain asepsis when performing patient-related interventions Speak up when sterile technique is violated
Cleaning / Disinfecting practices	

Compliance Barriers: · Staffing constraints, · Inconsistent practices, · Inconsistent feedback	**High touch surfaces** · Doorknobs, bed rails, medical equipment **UV light disinfection** **Hydrogen peroxide vapor systems (Hill)**
Standard precautions / additional precautions	Hand hygiene Proper use of PPE Proper handling of equipment and linens
Patient education	Concept of multi-drug-resistant organism Contact precautions Isolation
Safety devices / safe injection practices **Compliance Barriers:** lack of safety devices or disposal equipment	Aseptic techniques Do not re-use Proper disposal Safety device Required by Occupational Safety and Health Administration (OSHA)
Bundle Strategies	
See Table 4	Nurse driven protocols to manage devices Bundles shown to reduce infections
Personal Health	
Fit for duty for staff	Healthcare workers should stay home when they are sick and stay current on immunizations
International Challenges	
Water, sanitation and hygiene (WASH) **Barriers:** Lack of basic water and sanitation services	Implement national road maps with proper financing Monitor / review progress Develop abilities of the health workforce to sustain WASH services Integrate WASH into health sector planning
Antimicrobial Stewardship	
Barriers: · Lack of decision support tools	Appropriate use of antibiotics · Right med, right dose, right duration ·Prevents antimicrobial resistance

PPE: personal protective equipment
OSHA: Occupational Safety and Health Administration
WASH: Water, sanitation, hygiene

Note: Hill, Lamichhane & Wamburu, 2024; Powers & Rogers, 2022; Yokoe et al., 2023; WHO, 2021

Table 4: Infection prevention bundles

Infection Prevention Bundles		
CLABSI Prevention Bundle		
	Basic Bundle	Bundle Details
Insertion		Assess appropriateness and need
		Insertion protocols, including a checklist
	Hand hygiene	Hand hygiene
	Site selection – subclavian is the optimal site; avoid femoral vein	Site selection – subclavian is the optimal site; avoid femoral vein
	Maximum sterile barrier precautions	Maximum sterile barrier precautions
	Chlorhexidine antisepsis	Chlorhexidine antisepsis
		Ultrasound guidance
		Inclusive kit/cart with supplies
Maintenance		Proper management of the line
		Change line w in 24 hours if inserted under suboptimal conditions
		Scrub the hub - cleaning needless ports
		Tubing change per policy: recommendation TPN / blood tubing: within 24 h of initiation Not used for blood/TPN: at least 96 h
		Transparent dressing change Q 7 days / when soiled; Gauze change Q 48h
	Review daily necessity; remove ASAP	Review daily necessity; remove ASAP
		CHG bathing daily
		Surveillance
		Sutureless securement devices

Patency		Catheter flushing technique
		Needless connectors with neutral zero fluid displacement
		Prophylactic antimicrobial lock solutions
		Standing orders for catheter occlusions
	CAUTI	
		Establish a nurse driven protocol for catheter management and urinary retention
	Assess need for indwelling catheter	Assess for alternative devices
	Hand hygiene	Hand hygiene
	Insertion	Asepsis Smallest catheter Only appropriately trained personnel insert catheters
	Catheter Management	Properly secure catheter Maintain a sterile close drainage system Maintain good hygiene at the catheter-urethral interface Maintain unobstructed urine flow Maintain drainage bag below the level of the bladder Do not change the catheter or drainage bag at arbitrary fixed intervals
		Culture only if symptoms are present
	Timely removal when not necessary	Monitor outcomes
	Ventilator Associated Pneumonia	
	Avoid intubation	Elevate HOB / semi-recumbent positioning
	Elevate HOB / semi-recumbent positioning	Turning / repositioning
	Minimize sedation	Early mobility
	Early Mobility	Subglottic secretion drainage (unresolved issue)
	Early enteral nutrition; post pyloric feeding	Closed suctioning circuits (unresolved issue)

	Ventilator circuits - change if visibly soiled or malfunctioning	Avoid nasogastric tubes
		Oral care, potentially with CHG 4xday (controversial)
		Early enteral nutrition; post pyloric feeding
		Assessment of readiness to wean
		Strategies to limit duration of mechanical ventilation(SAT and SBT)
		Ventilator circuits - change if visibly soiled or malfunctioning
		Minimize sedation
		Consider early trach
		Peptic ulcer disease prophylaxis
		DVT prophylaxis

Note: Buetti, N., et al., 2022; Eppling, J. & Nickel, R. 2023; Gupta,P., et al., 2021; Hill, B., Lamichhane, G., & Wamburu, A. 2024; , Jarding & Makic, 2021; Klompas, et al., 2022; Mazzeffi, M., et al., 2025; Patel,et al., 2023; Powers, J., Rogers, C. 2022; Shannon, D.J., Lau, D., Grota, P.G. 2025; P.G.Yokoe,et al., IHI, 2023

Strategies to Mitigate the Risk of HAI: Vertical vs Horizontal

Infection prevention can be approached from either a vertical or horizontal perspective. The vertical approach is implemented for a specific time and integrates active surveillance testing and contact isolation for infected or colonized patients. The effectiveness of contact isolation for MDROs (multi-drug-resistant organisms) continues to be controversial. Vertical strategies have associated costs related to the cost of lab work, personal protective equipment (PPE), creation of biomedical waste, and the indirect cost of staff education.

Horizontal strategies are broader and prevent infection by targeting a mode of transmission. Examples of horizontal infection control strategies include hand hygiene, chlorhexidine (CHG) bathing, environmental decontamination, antimicrobial stewardship, universal masking, and selective digestive tract decolonization. Although horizontal strategies are more cost effective, certain components, such as CHG bathing and environmental decontamination, carry a significant cost. IPC are a combination of horizontal and vertical strategies (Abbas & Stevens, 2024). Whether vertical and horizontal prevention strategies, the foundation of infection prevention is effective hand hygiene.

Hand Hygiene: Foundation of Prevention

Proper hand hygiene (HH) is the foundation of all infection prevention and control (IPC) programs. “Hand hygiene is one of the key performance indicators of patient safety and quality worldwide.” (deKraker et al., 2022, p 835). Contaminated hands are the primary source of pathogenic spread (Arvidsson, Lindberg, & Skytt, 2025; Toney-Butler, Gasner, & Carver, 2023; WHO 2009a). Proper hand hygiene decreases pathogenic spread, infection risk, healthcare costs, and length of stay. In 2009, the WHO launched the “Five Moments of Hand Hygiene” to establish an evidence based process for hand hygiene (table three). The WHO “Five Moments of Hand Hygiene” are supported by the International Society for Infectious Diseases (Stewardson & Pittet, 2018) and the Joint Commission on Accreditation (TJC, 2025). These guidelines were developed to foster positive outcomes by linking hand hygiene behaviors to specific outcomes in patients and healthcare workers (WHO, 2009b). The United States Centers for Disease Control and Prevention also has standards for hand hygiene (table three). The Joint Commission National Patient Safety Goal on infection prevention requires that individuals follow either the WHO or CDC standards for hand hygiene (TJC, 2025).

The WHO acknowledges that education alone is not the solution to HH compliance. The WHO multimodal hand hygiene improvement strategy (MMIS) addresses system and performance issues related to HH (table five). In addition to the MMIS, there are other essential practices related to hand hygiene (table six), recommended by the Society of Epidemiology of America (SHEA), the Infectious Disease Society of America (IDSA), and the Association for Professionals in Infection Control and Epidemiology (APIC).

***Table 5**: WHO Multimodal Improvement Strategy (MMIS)*

System change	Infrastructure Safe water supply, soap, towels Alcohol based hand gel at the point of care
Training and education	Regular training on the 5 Moments of Hand Hygiene Need for hand gel versus soap and water
Evaluation and feedback	Establish monitoring practices to include staff feedback
Reminders in the workplace	When, how, why

Institutional safety climate	Institutional and individual awareness of hand hygiene Partnership with patients

Note: WHO, 2009a

Table 6 *Additional Essential Practices*

Maintain healthy hand skin and fingernails	Short, natural fingernails, not past the end of the fingers No artificial nails for high risk areas Use of nail polish is organization specific
Appropriate products	Alcohol based hand gel accessible at the point of care; minimum 60% alcohol
Accessibility of hand hygiene supplies	Clear presentation of alcohol based hand gel at the point of care Sufficient number of dispensers for the area
Ensure appropriate glove use	Hand hygiene before and after use of gloves Gloves for all contact with patient and environment as indicated by standard and contact precautions
Reduce environmental contamination from sinks / sink drains	Handwashing sinks must meet local codes Dedicate sinks to handwashing, not for disposal of other fluids Clean sinks with approved cleaners

Note: Glowicz et al., 2023

In addition to establishing standards for hand hygiene, the WHO developed an action plan for organizations to establish and sustain an effective hand hygiene program (table 7). This action plan defines steps for organizations to assess readiness for change, assess their baseline status, implement the action plan, evaluate the success and establish a process for sustainability.

Table 7*: Hygiene Action Plan*

Hand Hygiene Action Plan	
Facility preparedness	Establish leadership Assess alcohol based hand gel planning tool Train observers Procure supplies Define / procure computer support Establish process for data acquisition / analysis

Baseline evaluation	Baseline assessment of HH compliance and supplies / equipment Survey leaders, front line staff on HH knowledge / perception
Implementation	Launch project Feedback baseline data Distribute educational materials Train staff
Follow up evaluation	Follow up on observation assessments Follow up: Survey leaders, front line staff on HH knowledge / perception Monitor use of products
Ongoing action plan and review	Evaluate impact through data analysis Provide feedback on current data Establish short and long term action plans for sustainability

Note. WHO, 2009

Ten years after the implementation of the WHO MMIS, deKraker and colleagues conducted an international survey to evaluate compliance with the WHO standards. The researchers received 3206 responses from 90 countries to evaluate compliance with the MMIS. The survey demonstrated a relationship between resources and compliance with the MMIS. Compliance ranged from a low of nine percent in low income countries, to a high of seventy percent in higher income countries (deKraker et al., 2022). A quarter of the facilities reported basic or inadequate levels of hand hygiene implementation, most of those from low income countries. Implementation was also lower in public versus private facilities. In addition, the WASH (water, sanitation, and hygiene) survey conducted by the WHO in 2020, reported that one third of the healthcare facilities do not have the resources to perform hand hygiene at the point of care; fifty percent do not have basic water services (WHO, 2021). Although there is no generally agreed upon percentage of HH compliance, the WHO suggests a goal of eighty percent. Although none of the countries reached eighty percent, there was an improvement in many countries from forty to fifty percent compliance before the implementation of the MMIS in 2009 (Lambe et al., 2019). Overall, multiple surveys conducted since 2009 have not demonstrated consistent improvement in hand hygiene (deKraker, et. al., 2022). The compliance challenges are not solely related to resources but to the institutional patient safety climate. The foundation of global health is in an effective IPC program, which starts with an effective hand hygiene program. Another key strategy in preventing infection, especially in critical care, is chlorhexidine bathing.

Chorhexidine Bathing

One of the essential strategies in a comprehensive IPC program in critical care is the adoption of a universal decolonization protocol, which includes a structured chlorhexidine (CHG) bathing program. CHG acts as a broad spectrum antiseptic, decreasing the bioburden of gram negative bacteria, gram positive bacteria, viruses and certain fungi (Brindle, 2023; Buller & Popovich, 2022; Molefe, et al., 2022; Reynolds, et al., 2021). A central line associated blood stream infection (CLABSI) can result from spread of skin organisms at the insertion site, direct contamination, hematogenous seeding from another focus or contaminated infusions (Peixoto, et al., 2024; Scheier et al., 2021). The negative impacts of CLABSI can include increased length of stay, increased morbidity and mortality, and unnecessary antibiotic use (Reynolds, et al., 2021). A CLABSI can increase mortality by as much as 25% (Peixoto, et al., 2024). In addition to CLABSI prevention, the CHG bundle plays a role in the prevention of other HAIs in critical care, including the transmission of methicillin resistant staphylococcus aureus (MRSA) (AHRQ, 2024). There has been extensive research to understand the impact of CHG on HAIs. A review by Gall, Long and Hall (2020) that included 42 articles, CHG bathing in critical care was shown to reduce multi-drug-resistant organisms (MDRO) acquisition and carriage, but not necessarily infection. In contrast, in the meta-analysis of critical care patients by Peixoto, et al., in six studies, daily bathing with CHG wipes decreased central line blood stream infection (CLABSI) by 48% compared to soap and water, although no significant decrease in critical care or hospital length of stay (LOS) was appreciated (moderate quality evidence) (Peixoto, et al., 2024).

Overall, the evidence supports daily CHG bathing for patients in critical care as an essential practice for the prevention of HAIs, in particular catheter associated blood stream infections. This practice is supported by the Society for Healthcare Epidemiology of America (SHEA), the Infectious Disease Society of America (IDSA) and the Association for Professionals in Infection Control (APIC) (APIC, 2025; Boyce, 2023; Buetti, 2022; Reynolds, et al., 2024).

Benefits of CHG Bathing

CHG bathing is relatively low cost, low tech, and relatively easy to adopt. It reduces MDRO acquisition, but not necessarily infection (Gall, Long & Hall, 2020). Resources to develop a CLABSI prevention program, which includes CHG bathing, are available on the AHRQ website (Molefe, et al., 2022) and include modules for central venous catheter indications and alternatives; insertion bundle; catheter maintenance; and catheter removal.

CHG Bathing Outside Critical Care

The benefits of CHG bathing outside critical care have not been clearly defined (Boyce, 2022; James, et al., 2025). The ABATE trial (Huang et al., 2019) evaluated the use of CHG bathing in non-critical care areas. The study was a cluster-randomized trial of 194 non-critical care units in 53 hospitals comparing universal CHG bathing and targeted mucopuricin (for patients that were known MRSA carriers) with routine soap and water bathing over a 21-month intervention period. The results demonstrated that although decolonization with CHG and mucopuricin did not significantly decrease MDRO infections;, targeted CHG bathing in patients with devices such as central lines, midline catheters, and lumbar drains demonstrated a thirty-two percent decrease in all cause blood stream infections; a 37% decrease in methicillin resistant staphylococcus aureus (MRSA) and vancomycin resistant enterococcus (VRE) (Huang, et al., 2019; James, et al., 2025; Molefe, et al., 2022). James and colleagues created a decision analytic model to examine the cost effectiveness of bathing strategies in non-critical care units (James, et al., 2025). Based on the data from the ABATE trial, the study by James and colleagues examined the costs of soap and water bathing, universal versus targeted decolonization, and the cost to hospitals versus payers if a patient develops a blood stream infection. Although the cost of soap and water bathing is the lowest, targeted decolonization was the most cost effective when considering the cost of supplies and equipment and the avoidance of hospital onset bacteremia (James, et al., 2025).

CHG Bathing Program

There are two options for CHG bathing: 2% impregnated cloth (no rinse) and 4% solution with multiple washcloths / multiple towels (Peixoto, et al., 2024). Figure three defines the AHRQ recommendations for CHG bathing with 2% impregnated cloths. One of the challenges in a CHG bathing program is patient refusal. Some patients do not like the sticky feeling left behind after bathing with the impregnated cloths. The nurse can work with the patient to help them to understand the importance of the intervention; potentially offer them another time for bathing. The priority for a successful CHG bathing program begins with using an evidence based bathing protocol that includes pictures of how to perform an effective CHG bath to standardize the process and define who will perform the bath. All skin care products used in the critical care units should be CHG compatible. It is important to use standard supplies and equipment, including the CHG impregnated cloth. Monitoring the bathing technique and providing immediate feedback is important to ensure the appropriate provision of a CHG bath. Ongoing staff education and learning from monitoring the bathing technique will support continuous learning (Boyce, 2023; Molefe, et al., 2022; Reynolds, et al., 2021).

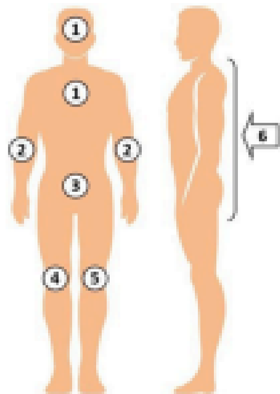
Section 10-1

Patients With Devices: Prevent Infections During the Hospital Stay

BATHE Daily With Chlorhexidine (CHG)

STAFF

Bathe hospital patients with devices every day with a special antiseptic (CHG) to help remove germs and prevent infection. Six cloths should be applied as below:



- Use all six cloths. Use more, if needed.
- Clean all skin. Avoid eyes and ear canals.
- Tell patient this is their protective bath.
- Encourage bathing every day.

Reminders

- CHG is better than soap and water at removing germs and works for 24 hours.
- CHG replaces soap and water for bathing.
- CHG is safe to use on normal skin and on surface wounds, rashes, and burns.
- Skin may feel sticky for just a few minutes until fully dry due to lotion or aloe vera in the cloths.
- Patients who self-bathe need direction on how to apply CHG thoroughly.
- Help patient clean 6 inches of all lines, tubes, and drains closest to the body.
- Your enthusiasm is the greatest predictor of patients wanting to use CHG.

Clean All Skin Areas

Pay special attention to:

- Neck (front and back)
- All skin folds
- Skin around all devices (line/tube/drain)
- Wounds unless deep or large
- Armpits, groin, between fingers/toes
- Safe on perineum, including female labia and genital surface

Clean All Medical Devices

- CHG is safe on devices.
- Clean skin around device. Clean over non-gauze dressings.
- Use clean part of CHG cloth to clean device itself to remove bacteria. Be sure to clean the 6 inches of any line, tube, or drain closest to the body.
- Allow CHG to air dry. Do not wipe off.

Bathing With CHG Cloths

- Firmly massage to clean skin. CHG will kill germs for 24 hours if applied well.
- Use only CHG-compatible lotions.
- Dispose of CHG cloths in a regular trash bin. Do not flush in commode.

Figure 3 AHRQ Recommendations for CHG Bathing

Note: www.ahrq.gov/sites/default/files/wysiwyg/hai/abate/handouts/staff-chg-cloth-bathing.docx

Barriers to a Successful CHG Bathing Program

Protocol compliance is a challenge. Reynolds reported studies with compliance rates of only 23 to 77%. Evidence based implementation strategies, documentation audit and feedback can improve compliance. If patient refusal is a factor in compliance, understanding why patients are refusing will be key to overcoming the barrier. Identifying barriers to success before initiating a CHG bathing program may help to mitigate potential barriers. Some barriers include lack of knowledge / understanding of the importance of a CHG bath, lack of time or motivation, and understanding the correct process to provide the CHG (Reynolds, et al., 2021). Another key component to infection prevention is antibiotic stewardship, which has the potential to save money and lives.

Antimicrobial Stewardship

One of the most cost-effective evidence-based interventions in infection prevention is antimicrobial stewardship, which ensures the right drug, in the right dose, right route, for the right duration, with appropriate de-escalation to pathogen specific therapy. Nurses play a pivotal role in ensuring that antibiotics are administered appropriately. The central goal of antimicrobial stewardship is to prevent antimicrobial resistance (Shrestha, Zahra, & Cannady, 2023). When combined with

appropriate hand hygiene, antibiotic stewardship has the potential to prevent seventy-five percent of deaths attributable to HAI (Tomczyk et al., 2022). Additional concerns for infection in critical care include the relationship between oral colonization and ventilator associated pneumonia.

Practice Questions: Infection Prevention and Control

1. Compliance with the WHO or CDC standards for hand hygiene are a standard of practice. Hand hygiene should be performed at all of the following intervals except:
    a. Before and after contact with the patient
    b. Moving from soiled body site to clean body site
    c. After contact with contaminated surfaces
    d. Entering a room without intent to touch the patient

2. An effective CHG bathing program in critical care is a key component to CLABSI prevention
    a. True
    b. False
3. What is one of the most cost effective evidence based interventions in infection prevention?
    a. Antimicrobial stewardship
    b. Education on the importance of hand hygiene
    c. Vertical approach to infection prevention, such as the use of PPE
    d. Ensure the appropriate use of PPE for all patients with MDROs

Answers: 1. d; 2. a; 3. a

Controlling Oral Colonization

The mouth is a primary reservoir for bacterial colonization. (Heo et al., 2008) Within two days of hospital admission, oral microbial communities often shift toward gram-negative rods and *Staphylococcus aureus*, increasing the risk for hospital acquired pneumonia. A study examining 89 critically ill patients demonstrated that when oropharyngeal flora were compared with VAP pathogens via pulsed-field gel electrophoresis, 28 out of 31 VAP cases showed identical DNA between oral and lung pathogens (Garrouste-Orgeas et al., 1997). Similarly, El-Solh and colleagues (2004) conducted DNA comparisons in 49 elderly patients from nursing homes: 14 developed pneumonias, and in 10 of these, the oral flora matched pneumonia-causing organisms. There is a direct link between the oral cavity and hospital acquired pneumonia. Current global rates of ventilator associated pneumonia (VAP) range between 2.3 to 43 per 1000 ventilator days (Mumtaz et al., 2023). Rates for non-ventilator hospital acquired pneumonia (NV-HAP) in high income countries are equally high at roughly 0.55 per 100 hospitalizations (Jones et al., 2023). Both contribute significantly to morbidity, mortality and longer ICU and hospital length of stays (Mumtaz et al., 2023 & Jones et al., 2023).

Evolution of Oral Care in ICU

Historically, critically ill patients received inconsistent oral care: nurses often improvised with tap water or non-therapeutic mouthwash on sponges, and lemon-glycerin swabs which are still used in some regions. These methods are not evidence- based. Multiple before-and-after studies and randomized trials show that structured oral care regimens significantly reduce VAP and NV HAP particularly when paired with staff education, though protocols vary widely. One intervention involved brushing, cleaning, suctioning, and moisturizing every four to six hours with training and compliance oversight, achieving a 63% reduction in VAP (Cuccio et al., 2012). A meta-analysis of 15 RCTs involving over 2,700 patients found that daily tooth brushing significantly reduced hospital-acquired pneumonia (HAP), especially in mechanically ventilated patients (RR ~0.67), and lowered ICU mortality and duration of ventilation and ICU stay. (Ehrenzeller & Klompas, 2024) Twice-daily CHG rinses are still used in many areas of the world but emerging data shows lack of efficacy in mechanically ventilated patients if not undergoing cardiovascular surgery (Simmons et al., 2024). The key to achieving this harm preventive fundamental nursing care practice is to be educated on the connection between the oral cavity and increase risk for pneumonia, develop and implement an evidence-based protocol and ensure oral care supplies are stocked and placed at the bedside for ease of use with critically ill patients.

Oral Care Beyond Ventilation

Non-ventilated intensive care patients are not immune to pneumonia risks: non-ventilator hospital-acquired pneumonia (NV-HAP) is more prevalent than VAP and carries similar mortality rates, contributing substantially to healthcare costs (Jones et al., 2023). In 2021, Giuliano and colleagues conducted a cluster-randomized trial in a large U.S. hospital outside the ICU setting. Over twelve months, four medical and surgical units at the 800-bed facility were assigned to either continue usual oral care practices or implement a structured tooth brushing protocol twice daily. In the medical units, raising the frequency of oral care from an average of 0.95 to 2.25 times per day was associated with an 85% decline in non-ventilator hospital-acquired pneumonia (NVHAP). They saw a smaller but non-significant reduction in the surgical units. Their protocol included brushing up to four times a day, a therapeutic mouth rinse and moisturization. Many US hospitals have reported similar findings upon introducing oral care protocols. and colleagues (2018) implemented an oral care protocol demonstrating a 92% reduction in NV-HAP with an estimated 2.84-million-dollar costs savings.
While the optimal frequency of oral care has not been fully established, the Center for Disease Control has created a hospital based oral care tool kit for health care providers to help establish programs based on various studies. It includes recommending brushing twice daily with a soft-bristled toothbrush and therapeutic toothpaste, plus an antiseptic rinse. For high-risk non-ventilated patients who cannot manage secretions, suction toothbrushes like those for ventilated patients may be warranted (Quinn et al., 2020). See figure four for an example of a simple oral care protocol for different types of ventilated and non-ventilated patients in a hospital. The final intervention to prevent patient harm includes addressing immobility.

Patient Type	Tools	Frequency
Self Care / Assist	Brush, paste, rinse, moisturizer • Soft-bristled toothbrush • Toothpaste with dentifrice • Antiseptic mouth rinse (alcohol-free) • Moisturizer (Petroleum-free)	4X / day
Dependent / Aspiration Risk	Suction toothbrush kit (4)	4X / day
Dependent / Vent	ICU Suction toothbrush kit (6) • CPC or 1.5% H2O2 for mechanical vent & CHG cardiac surgery patients	6X / day
Dentures	Denture cup, brush Cleanser Adhesive	4X / day

Figure 4 Example of an oral care protocol for all types of patients in Acute Care

Practice Questions:

1. What is the primary reason oral colonization increases the risk for hospital-acquired pneumonia?
   a. Saliva production increases bacterial growth
   b. The oral cavity rapidly becomes dominated by gram-negative rods and *Staphylococcus aureus* after hospital admission
   c. Oral care supplies are often unavailable at the bedside
   d. Non-ventilated patients receive more frequent oral care than ventilated patients
2. According to recent evidence, which intervention showed the most significant impact in reducing ventilator-associated pneumonia (VAP) in ICU patients?
   a. Daily use of lemon-glycerin swabs
   b. Brushing, suctioning, and moisturizing every 4–6 hours with staff training and compliance oversight
   c. Routine use of colored water mouthwash
   d. Twice-daily chlorhexidine (CHG) rinses in all ventilated patients
3. Which statement best reflects the current understanding of chlorhexidine (CHG) oral rinses in mechanically ventilated patients?
   a. CHG rinses are universally effective in reducing pneumonia across all ICU populations
   b. CHG rinses are recommended four times daily for all ventilated and non-ventilated patients
   c. Emerging evidence suggests CHG has limited benefit except in cardiovascular surgery patients
   d. CHG rinses are considered more effective than brushing and suctioning combined

Answers: 1.b; 2.b; 3. C

Physiologic Impact of Immobility

Immobility can have a significant physiologic impact on the neuromuscular, cardiovascular, and respiratory systems and result in a complex disease process referred to as ICU Acquired Weakness (ICUAW). ICUAW is experienced by 30 to 57% percent of patients in critical care units (Mart, et al., 2020; Taylor, 2020). As a prevention strategy, early mobility is a key element in The Society of Critical Care Medicine's ICU Liberation Bundle (A-F bundle), a collection of resources to help manage pain, agitation, delirium, immobility, and sleep disruption in critical care (Lewis, et al., 2025). Despite that recommendation, there is little evidence that mobility interventions are consistently in place in critical care units (Dirkes & Kozlowski, 2019). An international survey with respondents from 47 countries demonstrated that only 57% had even partially implemented the ICU Liberation bundle (Schallom, et al., 2020).

Impact on Organs Musculoskeletal

Muscle strength declines by 1-1.5% per day with bed rest. Patients can lose up to forty percent of their muscle strength in the first week of immobility (Dirkes & Kozlowski, 2019). Factors that contribute to muscle loss include lack of use, muscle atrophy, nutritional deficiencies, decreased muscle protein synthesis, and insulin resistance. Aging also exacerbates inactivity muscle loss. (Dirkes & Kozlowski, 2019; Schaller, et al., 2024). Decreased muscle strength can have a negative effect on balance, resulting in increased risk for falls. An imbalance of bone resorption and formation results in a reduction in bone integrity, increasing the risk for fractures. Muscle weakness presents symmetrically, impacting all four limbs and the respiratory muscles (Piva, Fagoni, & Latronico, 2019; Taylor, 2022).

Respiratory

In addition to skeletal muscle weakness, immobility has a significant impact on the respiratory system. Muscle atrophy and the resulting diaphragmatic dysfunction occurs in 25-65% of patients after five days on a mechanical ventilator. The dysfunction impacts the ability of the diaphragm to contract (Dirkes & Kozlowski, 2019; Piva, Fagoni, & Latronico, 2019; Mart, et al., 2022). Patients who are not intubated may present with rapid shallow breathing, the use of accessory respiratory muscles, paradoxical abdominal movement, hoarse / nasal voice, atelectasis, and an increased risk of aspiration (Taylor, 2022).

Cardiovascular

The cardiovascular system is also negatively impacted by immobility. Just the act of lying down shifts up to eleven percent of total blood volume away from the legs, most going to the chest. The movement of blood into the chest increases the cardiac workload, presenting with a progressive increase in heart rate, decreased cardiac filling time, and a resultant decreased cardiac output. Prolonged bedrest can result in a decrease in stroke volume of up to thirty percent. Baroreceptor dysfunction results in orthostatic intolerance (Dirkes & Kozlowski, 2019).

ICU Acquired Weakness: Pathophysiology

The failure of the neuromuscular, respiratory, and cardiovascular systems assimilates to result in a syndrome recognized as "ICU acquired weakness (ICUAW)." ICUAW is a "diffuse, symmetric weakness involving all extremities and respiratory muscles arising after the onset of critical illness" (Piva, Fagoni, & Latronico, 2019, p. 4). ICUAW can result from critical illness polyneuropathy, critical illness myopathy, or muscle disuse atrophy (table eight). Thirty to fifty-seven percent of patients in critical care for greater than seven days will develop ICUAW (Piva, Fagoni, & Latronico, 2019).

The risk factors associated with ICUAW are associated with dysfunctional microcirculation also seen in sepsis and critical illness. The risk factors associated with ICUAW are included in table nine.

Table 8: *ICU Acquire Weakness Definition*

Critical illness polyneuropathy (CIP)	An axonal, sensory-motor polyneuropathy with reduced nerve excitability and loss of axon with preserved myelin sheath
Critical illness myopathy (CIM)	A primary acute myopathy with reduced muscle membrane excitability and loss of myosin filaments, fiber atrophy, and necrosis
Combined critical illness polyneuropathy and myopathy (CRIMYNE)	Combined CIP and CIM

Note. Piva, Fagnoni, and Latronico, 2019

Table 9: *Risk Factors for ICU Acquired Weakness*

Probable	Possible
Sepsis	**Severity of illness**
Multiple organ dysfunction syndrome	**Increased age**
Prolonged mechanical ventilation	**Steroids**
Hyperglycemia	**Neuromuscular blocking agents (3-5 days)**
Systemic inflammatory response syndrome	**Older age**
Hyperglycemia	**Female gender**

Prolonged immobility	Hypoalbuminemia
	Parenteral nutrition
	Vasopressors
	Aminoglycosides
	Thyrotoxicosis

Note. Nasuelli, et al., 2024; Taylor, 2022

ICU Acquired Weakness: Management

Management of ICUAW starts with prevention, including an interdisciplinary early mobility program. Early mobility is defined as "active mobilization provided to ICU patients as soon as physiologically stable and continued throughout the ICU stay" (Bach & Hetland, 2022, p. 14). It is critical to include nurses, physical therapists, occupational therapists, providers, and administrators in planning and implementing an early mobility program. The role of the administrator is to ensure that the appropriate personnel and equipment resources, such as mechanical lifts, hover mats, or tilt tables are available (Schallom, et al., 2020). Clinicians will consider the benefit of early mobility with the risks of endotracheal tube dislodgement, hemodynamic instability, fall risk, patient's weight, sedation status, and pain management before mobilizing a patient (Dirkes & Kozlowski, 2019). Strategies to ensure the patient is ready for early mobility include early intervention for sepsis, ensuring normoglycemia, minimizing sedation, and judicious use of vasopressors, corticosteroids, and neuromuscular blocking agents. Early mobility interventions should be initiated within seventy-two hours of admission to critical care (Schaller, et al., 2024).

The American Association of Critical Care Nurses (AACN) has a two-step Early Progressive Mobility Protocol. Step one recommends screening for safety, to ensure the patient is physiologically stable and ready for mobility. Individual critical care units can customize these steps to meet the needs of their specific population. Step two defines four levels of activity that begin with passive range of motion and progresses to ambulation (figure 5).

Figure 5: *AACN Early Progressive Mobility Protocol Note. Decker, Messina, Ruby, Schmitz, 2019; Schallom, et al., 2020*

Once mobilized, the clinicians will continue to reassess the patient's physiologic stability to ensure patient safety. Table ten provides guidelines to discontinue mobilization due to physiologic instability, although clinical judgement is critical. Deciding the duration, exertion by the patient, and frequency of mobilization is challenging. Evidence suggests that duration influences effectiveness (Schaller, et al., 2024).

The ICU Liberation guidelines from SCCM support the implementation of an early mobility program. The outcomes from implementation of the guidelines are clear that early mobility has a positive outcome for patients. Table eleven reviews the details of the outcomes from early mobility. SCCM has free resources to support the ICU Liberation guidelines (ICU Liberation Resources | SCCM).

***Table 10**: Recommendations to Stop Mobilization*

Desaturation <86%
Heart rate > 30% from baseline
Systolic blood pressure >/= 40mmHg from baseline
Diastolic blood pressure >/= 20 mmHg from baseline
Mean arterial blood pressure < 60 mmHg
New onset or worsened cardiac arrhythmia requiring treatment
Deterioration of level of consciousness
Pain that cannot be treated with pain therapy

Note: Schaller, et al., 2024, p 1217

***Table 11**: Outcomes from Early Mobility Programs*

↓ ICUAW
Slight ↓ in duration of delirium, mechanical ventilation, ICU LOS, hospital LOS
Improves QOL and functional outcomes
↓Deep vein thrombosis, Ventilator associated pneumonia, pressure injury
Slight ↑ in arrhythmias, accidental line removal, unplanned extubation (adverse events 2.6-3.9%)
↓ Need for rehabilitation
↓ Incidence of delirium
↑ Ventilator free days
Enhanced glycemic control
↓ Readmission rate
Improved mental health / ↓ post-traumatic stress disorder

Note. Dirkes & Kozlowski, 2019; Mart, et al., 2022; Lewis, et al., 2025; Piva, Fagoni, & Latronico, 2019; Schaller, et. al., 2024; Schallom, et. al., 2020 Zang, et al.; 2018; Zhang, et al., 2019

Post Intensive Care syndrome

Although ICU survivorship has improved over time, patients who survive critical care are experiencing deficits in physical, psychological, and cognitive function, resulting in a disorder defined as “post intensive care syndrome” (PICS). Although ICUAW may be one risk factor, other factors such as prolonged mechanical ventilation, level of sedation, presence and duration of delirium, and negative memories of their critical care experience also play a role. Patients who develop PICS may have a decreased quality of life and increased healthcare costs (Bach & Hetland, 2022). Since ICUAW is a key factor, early mobility plays a pivotal role in the prevention of PICS.

Practice Questions:

1. Immobility is a risk factor for ICU acquired weakness. Which of the following are factors that contribute to musculoskeletal dysfunction in ICUAW?
    a. Lack of use
    b. Muscle atrophy
    c. Nutritional deficiencies
    d. Decreased muscle synthesis

e. All factors contribute to musculoskeletal dysfunction

2. What is the key impact of immobility on the respiratory system?
   a. Increased work of breathing
   b. Muscle atrophy resulting in diaphragmatic dysfunction
   c. Hypoxemic respiratory failure
   d. Increased minute ventilation
3. Strategies to ensure the patient is ready for early mobility include all of the following except:
   a. Minimizing sedation
   b. Judicious use of vasopressors, corticosteroids, and neuromuscular blocking agents
   c. Ensuring normoglycemia
   d. High risk for falls

Answers: 1. e; 2. b; 3. d

Summary

This chapter emphasizes the central role of critical care nurses in preventing avoidable harm by ensuring the delivery of high-quality, evidence-based fundamental nursing care. It begins by examining the concept of missed nursing care and its impact on patient safety, highlighting how gaps in basic practices can lead to preventable harm. The chapter introduces the Fundamentals of Care Framework, which supports the reintegration and valuing of essential care practices when paired with the right systems and resources for sustainability.

Key areas of focus include strategies to prevent pressure injuries and manage risks associated with shear, friction, and moisture, as well as evidence-based interventions to reduce healthcare-associated infections (HAIs). The chapter reviews the consequences of HAIs on mortality, morbidity, and cost, while outlining the core components of the World Health Organization's Infection Prevention and Control Program and multimodal hand hygiene strategy. Practical approaches to implementing care bundles for central line-associated bloodstream infections, catheter-associated urinary tract infections, and ventilator-associated pneumonia are also detailed.

Attention is given to the physiological effects of immobility and the complications of ICU-acquired weakness and delirium, both of which affect short- and long-term recovery. Early mobility protocols, including the AACN's progressive mobility model, are discussed alongside key research findings that demonstrate improvements in outcomes when patients are mobilized early and consistently.Through integrating evidence-based strategies across skin care, infection prevention, mobility, and cognitive health, this chapter underscores how critical care nurses can profoundly influence recovery trajectories and long-term quality of life for critically ill patients.

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