

## Review

# Evidence-Based Insights into Prevention and Healing of Pressure Ulcers: A Review

Herath, H.M.C.M\*, & De Silva, D.K.M.

*Department of Clinical Nursing, Faculty of Nursing, University of Colombo, Sri Lanka*

## Abstract

**Introduction:** Pressure ulcers (PU) remain a major clinical challenge, particularly among patients with limited mobility or in long-term care. They increase morbidity, hospital stay, and healthcare costs. Effective prevention and management are vital for improving outcomes. This review summarizes current evidence-based strategies for pressure ulcer prevention and treatment.

**Methods:** A systematic search was conducted in PubMed, SpringerLink, ScienceDirect, and Google Scholar using the terms “pressure ulcers,” “management,” and “prevention” for studies published from 2005 to 2025. These were screened for relevance by the first reviewer, and any uncertainties regarding eligibility were discussed and resolved in consultation with the second reviewer. The final search was completed on 31 January 2025. Following the PRISMA guidelines, 51 studies met the inclusion criteria, including 12 systematic reviews and meta-analyses, seven randomized controlled trials, 10 guidelines and scoping reviews, 16 observational studies, four narrative reviews, one expert opinion, and one case report.

**Results:** Evidence indicates that early and regular risk assessment is crucial for identifying vulnerable patients. The Braden Scale, combined with clinical judgment, enhances prediction accuracy. Key preventive strategies include (1) regular repositioning, (2) maintaining skin integrity, (3) optimizing nutrition and hydration, and (4) using pressure-relieving devices. For existing ulcers, effective wound care, infection control, and pain management accelerate healing. Emerging technologies such as advanced dressings and innovative pressure-relief systems demonstrate improved outcomes.

**Conclusion:** Preventing and managing PU requires a coordinated, evidence-based approach emphasizing risk assessment, skincare, nutrition, and pressure redistribution. Early identification of at-risk individuals and consistent use of repositioning and pressure relief interventions significantly reduce ulcer incidence. Integrating multidisciplinary, patient-centered strategies enhances healing, safety, and quality of care.

**Key Words:** *Pressure ulcers, management, prevention, patient outcomes*

*Sri Lankan Journal of Nursing, 2025, 4(2): 99-119*

**Correspondence:** H.M.C.M. Herath, Department of Clinical Nursing, Faculty of Nursing, University of Colombo, Sri Lanka. Email: [chandraniherath@dcn.cmb.ac.lk](mailto:chandraniherath@dcn.cmb.ac.lk) .  <https://orcid.org/0000-0001-7300-7607>

**Received:** 21<sup>st</sup> May 2025; **Accepted:** 09<sup>th</sup> November 2025; **Published** 30<sup>th</sup> December 2025

**How to cite:** Herath, H.M.C.M. & De Silva, D.K.M. (2025). Evidence-based insights into prevention and healing of pressure ulcers: A Review. *Sri Lankan Journal of Nursing*, 4(2), 99-119.



This article is published under the Creative Commons Attribution-Share Alike 4.0 International License (CC-BY-SA). This license permits use, distribution and reproduction in any medium; provided it is licensed under the same terms and the original work is properly cited.

## **Introduction**

Pressure ulcers are serious, painful, and largely preventable injuries that can affect individuals across all age groups. Formerly known as bedsores or decubitus ulcers, pressure ulcers are localized damage to the skin and underlying tissues, typically occurring over bony prominences due to sustained pressure or shear forces (Chou et al., 2013). Commonly affected areas include the occiput, trochanters, sacrum, malleoli, and heels (Bhattacharya & Mishra, 2015). These ulcers remain a major challenge in healthcare settings, leading to prolonged hospital stays, increased morbidity, reduced quality of life, and significant financial burden on healthcare systems (Mizokami et al., 2014).

Despite extensive research and the availability of preventive guidelines, the incidence and recurrence of pressure ulcers remain high, particularly among individuals with limited mobility, poor nutritional status, or inadequate nursing care (Li et al., 2020). This persistent prevalence indicates gaps between evidence-based recommendations and clinical practice implementation. Moreover, while numerous risk assessment tools exist, their predictive accuracy and consistency across different patient populations are still debated, leading to challenges in the timely identification of at-risk individuals (Vera-Salmerón et al., 2022).

In addition, most studies emphasize either prevention or treatment in isolation, whereas an integrated, multidisciplinary approach involving vascular specialists,

plastic surgeons, nurses, and physiotherapists is essential for optimal outcomes but remains underutilized or inconsistently applied in clinical practice (Amêndoa et al., 2025). Furthermore, advances in technology such as pressure sensing devices and digital wound monitoring systems, are not yet universally adopted, reflecting another gap between innovation and practice.

Therefore, this review aims to provide a comprehensive overview of current evidence-based strategies for pressure ulcer prevention and management, while critically emphasizing clinical practice, assessment tools, and interdisciplinary care. Addressing these evidence-based strategies is vital to improve patient outcomes, enhance care quality, and reduce the overall burden of pressure ulcers on healthcare systems.

## **Methods**

This review of the literature was conducted in January 2025, with the final database search completed on 31 January 2025. A comprehensive search strategy was applied across four major databases, SpringerLink, PubMed, Google Scholar, and ScienceDirect, to identify relevant publications on pressure ulcer prevention and management. The search terms used were tailored for each database. For SpringerLink, the terms “pressure ulcers” or “decubitus ulcers” combined with “management” and “prevention” were applied. In PubMed, the search included “pressure ulcers,” “management,” and “prevention.” For Google Scholar, the

terms “pressure ulcers” or “decubitus ulcers” were combined with “management” and “risk assessment.” In ScienceDirect, the search was conducted using “pressure ulcers,” “management,” and either “prevention” or “risk assessment.”

The review included studies published in English between 2005 and 2025, encompassing original research articles, review papers, books, and published clinical guidelines.

Two independent reviewers conducted the literature review process. Initially, all titles and abstracts published between 2005 and 2025 were screened for relevance by one reviewer, and any uncertainties regarding eligibility were discussed and resolved in consultation with the second reviewer. Full-text articles of potentially relevant studies were then retrieved and assessed according to predefined inclusion and exclusion criteria, resulting in 51 studies being included in the final review (Figure 1). Given the scope of this review, data extraction focused on key bibliographic and outcome information, including the author, year of publication, and main findings of each study. Both reviewers independently extracted this information, and any discrepancies were resolved through discussion until consensus was reached; no third reviewer was required. Inter-rater agreement during the screening phase was 97.8%, indicating strong consistency between the reviewers.

## **Results and discussion**

The most common types of included literature are observational studies and

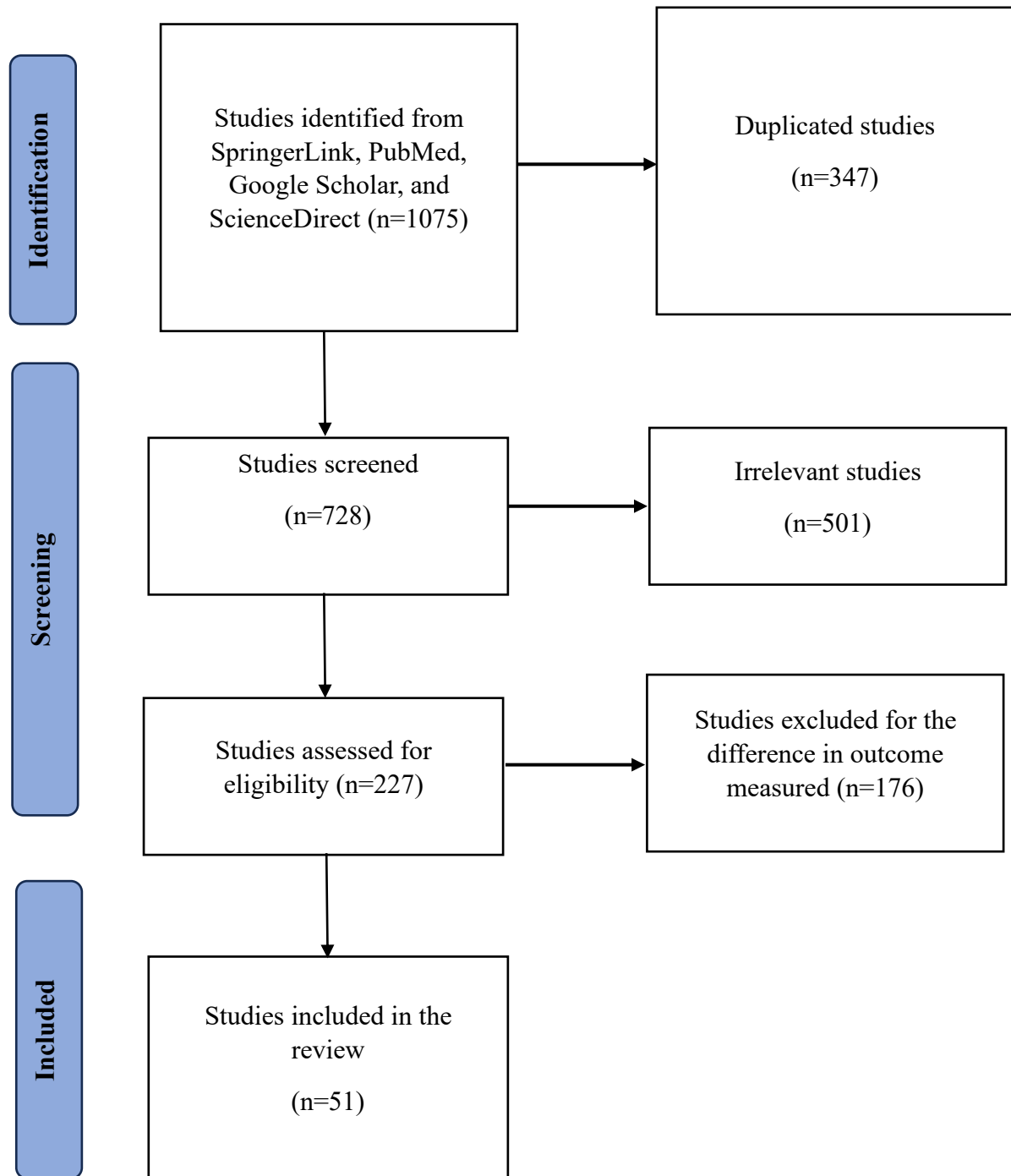
systematic reviews/meta-analyses, followed closely by clinical practice guidelines. This blend indicates a strong reliance on synthesized, high-level evidence while also using real-world data to address implementation and prevalence issues. Table 1 shows the summary of studies retrieved in the current review.

## **Management of pressure ulcers**

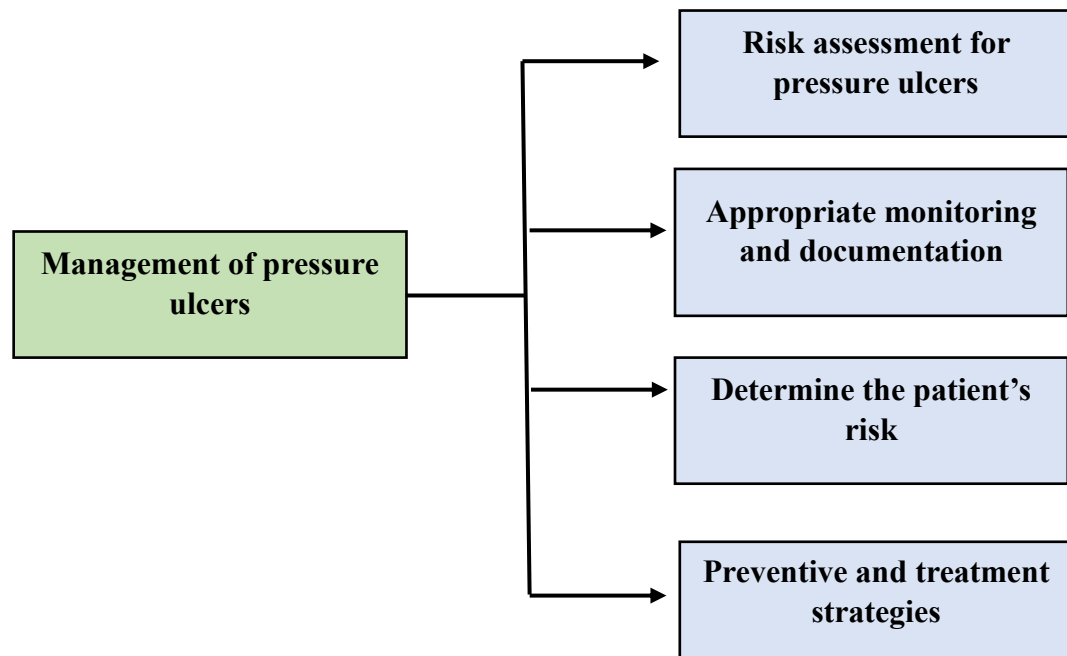
The clinical assessment of pressure ulcers is a critical aspect of patient care, particularly in vulnerable populations such as older people and those with limited mobility. A pressure ulcer management algorithm is a systematic, step-by-step process that helps healthcare professionals assess risk, implement preventive measures, and provide treatment for patients at risk of developing pressure ulcers or already experiencing them. This approach involves evaluating the patient's condition, planning suitable interventions, carrying out those interventions, and continuously reassessing the patient's risk and treatment progress according to established guidelines, such as those from the European Pressure Ulcer Advisory Panel (Crunden et al., 2022). There are four stages of pressure ulcer management, including: (1) Risk assessment for pressure ulcers; (2) Determining the patients' risk; (3) Preventive and treatment strategies and (4) Appropriate monitoring and documentation (Figure 2).

## **Risk assessment for pressure ulcers**

Effective risk assessment is fundamental in preventing pressure ulcers (Vera-Salmeron, et al., 2022). This process includes a



**Figure 1: Search and selection of eligible studies**



**Figure 2: Management of pressure ulcers (Source: Crunden et al., 2022)**

thorough assessment of skin and tissue, the application of standardized risk assessment tools, and the use of clinical judgment (Stephenson et al., 2021). This area was identified through a comprehensive review of literature, which highlighted the importance of early detection, standardized risk assessment tools, and the integration of clinical judgment.

A comprehensive skin and tissue assessment is essential for identifying early signs of pressure damage. This evaluation should be performed as soon as possible after admission, repeated regularly throughout the patient's stay, and again before discharge. Particular attention should be given to areas over bony prominences, such as the sacrum, heels, and greater trochanters. In neonates and young children, the occiput should also be assessed because their proportionally larger

head size increases the risk of pressure injury in this area (NPUAP, EPUAP, NPIAP, & PPPIA, 2014).

### **Risk assessment tools and guideline alignment**

Accurate and systematic risk assessment is a cornerstone of effective PU prevention and management. A range of validated tools is available to support clinical judgment in identifying individuals at risk. The most widely utilized instruments include the Braden Scale, Waterlow Scale, Norton Risk Assessment Scale for adults, and the Braden Q Scale for pediatric populations (Barker et al., 2013; Lospitao-Gómez et al., 2017; Gunningberg et al., 2015). These tools evaluate multiple factors that influence skin integrity, including mobility, activity, moisture, nutrition, friction, shear, and sensory perception

(Barker et al., 2013).

Among these, the Braden Scale remains the most commonly adopted internationally due to its strong predictive validity and ease of integration into clinical workflows (Zambonato et al., 2013). The scale comprises six subscales: sensory perception, moisture, activity, mobility, nutrition, and friction/shear. Each subscale is rated according to the patient's current condition, with scores ranging from 1 (least favorable) to 4 (most favorable) for five subscales, and 1 to 3 for friction and shear. The total score, therefore, ranges from 6 to 23, with lower scores indicating higher risk of PU development (Barker et al., 2013).

The European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) (2019) guidelines emphasize that the Braden Scale should be used as part of a comprehensive clinical assessment, not as a standalone diagnostic tool. According to these international guidelines, risk categorization thresholds should be adapted to the patient population and care setting. While early literature (e.g., Zambonato et al., 2013) defines cutoffs as mild risk (15–18), moderate risk (13–14), high risk (10–12), and very high risk ( $\leq 9$ ), the EPUAP/NPIAP/PPPIA (2019) framework recommends that clinicians interpret total scores contextually, taking into account individual comorbidities, perfusion status, and environmental factors. This approach ensures that borderline scores are not overlooked and that preventive interventions are initiated proactively.

Recent research supports the continued use of the Braden Scale, but also highlights its limitations when used in isolation. For instance, a systematic review by Huang et al. (2021) confirmed that while the Braden Scale demonstrates moderate sensitivity and specificity, its predictive accuracy improves significantly when combined with clinical judgment and ongoing skin assessment. Similarly, Stephenson et al. (2021) and Vera-Salmerón et al. (2022) emphasized that standardized tools should complement, rather than replace, clinical reasoning, as patient factors such as perfusion deficits, nutritional status, and incontinence may not be fully captured within numerical scoring systems.

In alignment with the EPUAP/NPIAP/PPPIA (2019) guideline, healthcare professionals should therefore adopt a multifactorial assessment strategy:

1. Utilize a validated risk assessment tool (e.g., Braden Scale) at admission, regularly during hospitalization, and following any significant change in the patient's condition.
2. Integrate findings with comprehensive skin and tissue evaluation, clinical judgment, and patient-specific risk factors.
3. Re-assess the patient's status at regular intervals and before discharge to guide preventive and therapeutic care planning.

This integrated approach aligns with current international best practices and ensures that risk identification remains both systematic and individualized, thereby

enhancing the early detection and prevention of pressure ulcers.

Risk assessment and monitoring enable healthcare professionals to implement specific prevention measures, including adhering to patient repositioning schedules, minimizing potential consequences, and reducing the risk of pressure ulcers. While standardized tools provide a structured framework for evaluating risk factors, clinical judgment remains essential. Health professionals must interpret results within the broader context of the patient's overall condition and additional risk factors that may not be captured by the tools. This comprehensive approach ensures the development of effective and individualized prevention plans (Crunden et al., 2022; Stephenson et al., 2021).

### **Determine the patient's risks**

Risk factors for pressure ulcers are classified as intrinsic or extrinsic (Garcia & Thomas, 2006). Intrinsic factors that contribute to skin issues include limited mobility, poor nutrition, co-morbidities, and aging skin. Extrinsic factors involve pressure from hard surfaces, friction with bed linen, shear forces from involuntary muscle movements, as well as moisture resulting from bowel or bladder incontinence, excessive perspiration, and wound drainage (Garcia & Thomas, 2006). The skin and tissues' susceptibility and tolerance to pressure and shear forces are affected by various factors, including skin

condition, blood circulation, oxygen levels, nutrition, moisture, body temperature, age, and sensory perception. For instance, individuals with diabetes mellitus, peripheral vascular disease, or malnutrition are at increased risk due to compromised tissue perfusion and healing capabilities (NPUAP, EPUAP, & PPPIA, 2014).

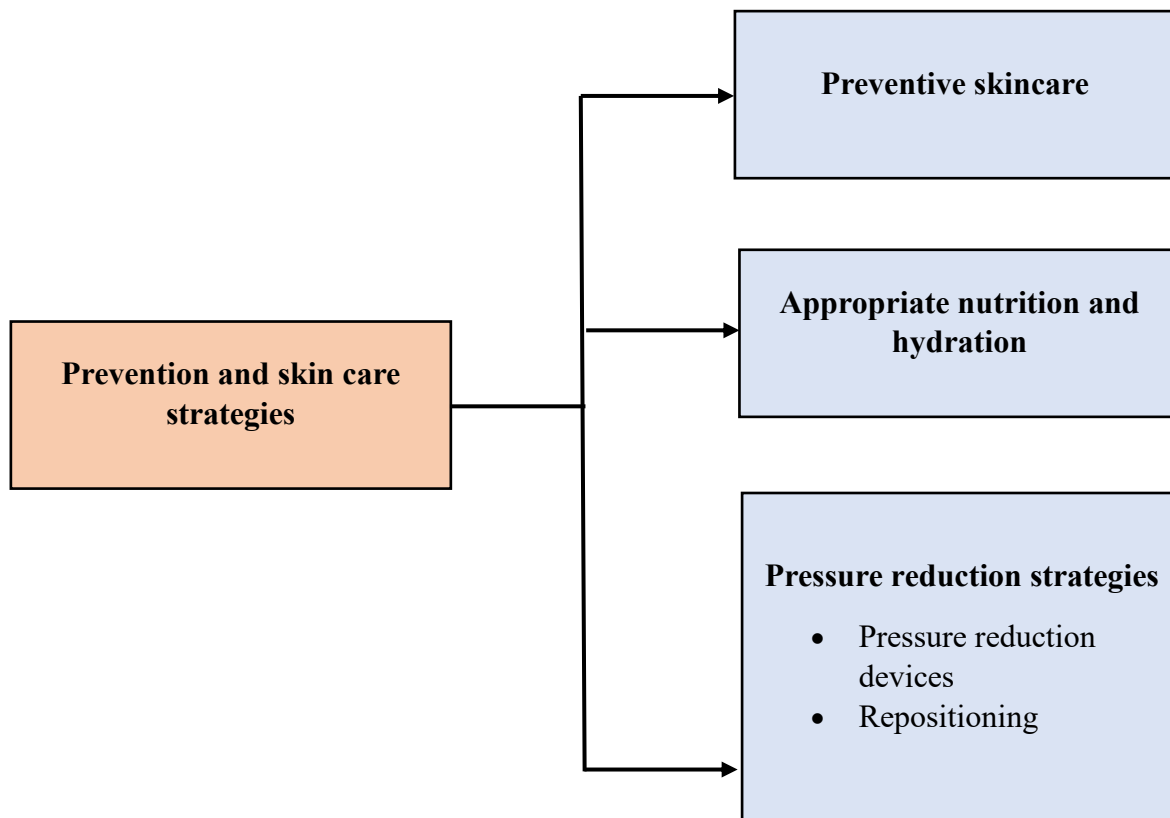
Caregivers should receive education on risk assessment and prevention strategies, and they should regularly check patients to prevent pressure ulcers or identify them in their early stages (O'Connor et al., 2021).

### **Preventive and skin care strategies**

Preventive measures should be used in at-risk patients. Pressure reduction to preserve microcirculation is a mainstay of preventive therapy (Bluestein & Javaheri, 2008). Three types of preventive strategies were identified: (1) Preventive skincare, (2) Appropriate nutrition and hydration, and (3) Pressure reduction strategies (Figure 3).

### **Cleansing**

Maintaining skin integrity through appropriate cleansing is fundamental to PU prevention. Haesler (2018) emphasizes the use of pH-balanced cleansers to minimize skin irritation and dryness, both of which can compromise the skin barrier. Gentle cleansing methods that avoid harsh soaps and excessive rubbing are recommended, particularly for patients with fragile or



**Figure 3. Pressure ulcer prevention strategies (Source: Bluestein & Javaheri, 2008)**

aging skin.

### ***Moisturizing***

Moisturizing plays a crucial role in maintaining skin hydration and reducing pressure ulcer risk. A quality improvement study by Shannon et al. (2009) demonstrated that a comprehensive skin care regimen, including regular application of emollients, significantly reduced pressure ulcer incidence and associated healthcare costs. However, the effectiveness of specific moisturizers varies across studies. Verdu and Soldevilla (2012) reported no significant difference between a hyper-oxygenated fatty acid moisturizer

and a placebo, whereas Torra et al. (2005) found that the same moisturizer significantly reduced PU incidence compared with a perfumed glycerol-based product.

### ***Moisture management***

Excess moisture from incontinence, perspiration, or wound exudate increases pressure ulcer risk by impairing the skin's natural barrier function (Gray et al., 2011). Effective moisture management is therefore essential to prevent skin maceration and subsequent injury. Doh and Heo (2021) highlight that maintaining optimal moisture balance enhances skin

integrity and reduces pressure ulcer incidence, especially in patients with incontinence.

Recent evidence reinforces this view. A systematic review by Wahyuni et al. (2023) identified moisture management, frequent repositioning, and the use of supportive surfaces as key components of pressure ulcer prevention. Similarly, Song et al. (2023) emphasize the need for structured nursing interventions incorporating moisture management to reduce pressure ulcer risk among high-risk populations.

Regular skin assessments and timely interventions to manage moisture are critical elements of comprehensive patient care (Mahran et al., 2024).

### ***Avoidance of massage***

Traditional practices once endorsed massage as a preventive measure for pressure ulcers; however, current evidence does not support its effectiveness. Duimel-Peeters et al. (2007) found no reduction in pressure ulcer risk with massage, and outcomes were slightly better among patients who did not receive it. Furthermore, consensus guidelines caution against vigorous rubbing, as it may contribute to tissue damage (Haesler, 2018).

### ***Integrated skin care approach***

A holistic approach that combines gentle cleansing, appropriate moisturizing, effective moisture management, and regular skin assessments has been shown to be most effective in preventing pressure ulcers. Park and Kim (2014) demonstrated

that a structured skin care protocol incorporating barrier creams and continence management significantly reduced pressure ulcer incidence compared with standard care.

Incontinence exposes skin to excess moisture and irritants in urine and feces, while incontinence aids may create an occlusive environment that alters the skin's microclimate. These factors can lead to inflammation, erythema, erosion, and loss of skin integrity, increasing susceptibility to pressure and shear injuries (Gray et al., 2011). Therefore, continence management interventions such as toileting programs, indwelling catheters, fecal incontinence devices, and disposable absorbent products should be integrated into pressure ulcer prevention plans. Notably, Francis et al. (2017) reported that the use of disposable products was associated with significantly shorter hospital stays.

### ***Low-friction textiles***

Recent studies have explored the relationship between low-friction coefficient textiles and pressure ulcer prevention across acute care, critical care, and aged care settings (Coladonato et al., 2012; Smith et al., 2013; Smith & Ingram, 2010; Yusuf et al., 2015).

These synthetic fabrics, made from silk-like fibers, provide smooth, quick-drying surfaces that reduce friction and shear stress during movement (Smith & Ingram, 2010). Used as bed linens, garments, or underpads, they wick away moisture, reduce heat insulation, and optimize the skin's microclimate (Smith et al., 2013).

Since moist skin exhibits a higher friction coefficient, these textiles can significantly lower PU risk (Coladonato et al., 2012). Although concerns exist regarding potential slips or falls, evidence indicates no increase in adverse events associated with their use (Smith et al., 2013).

### ***Prophylactic dressings***

There is growing clinical evidence supporting prophylactic dressings as part of comprehensive pressure ulcer prevention protocols. When combined with appropriate support surfaces and regular repositioning, dressings such as hydrocolloid and film dressings have been shown to be particularly effective in preventing heel pressure injuries and those caused by medical devices.

Film dressings, due to their thin and flexible design, are easier to apply beneath devices. However, a comparative study by Yoshimura et al. (2018) found that multilayer silicone foam dressings were more effective than film dressings in reducing the incidence of category 1 PU's in surgical patients.

### **Nutrition and hydration**

Nutrition plays a crucial role in both the prevention and treatment of pressure injuries, as all organ systems require macro and micronutrients to fulfill their needs for the growth, development, maintenance, and repair of body tissues (Kennerly et al., 2015). Individuals who are well-nourished are at a lower risk of developing pressure injuries compared to those who are malnourished. However, it is important to

note that both well-nourished and undernourished individuals can encounter skin integrity issues under certain circumstances (Kennerly et al., 2015).

Malnutrition can significantly affect the development and healing of pressure injuries. Both inadequate nutritional intake and undernutrition have been associated with the emergence of pressure injuries, their severity, and prolonged healing times (Iizaka et al., 2010). Water is essential as it acts as a solvent for vitamins, minerals, glucose, and other nutrients. It is also necessary for transporting these nutrients throughout the body and for eliminating waste products. Therefore, it is important to provide and encourage adequate water and fluid intake for hydration in individuals at risk of or already dealing with pressure injuries, as long as it aligns with their care goals and clinical condition (Mahmoodpoor et al., 2018).

### **Pressure-reducing and pressure-relieving devices**

Pressure-reducing devices play a crucial role in minimizing the risk of pressure ulcer development by decreasing tissue interface pressure to below the capillary closing pressure of approximately 32 mmHg (Thomas, 2006). These devices are generally categorized as static (stationary) or dynamic (active), depending on whether they redistribute pressure through passive or powered mechanisms.

#### ***Static devices***

Static devices, such as high-specification foam mattresses, are recommended for

individuals at high risk of developing pressure ulcers and should be used in place of standard hospital foam mattresses whenever possible. These surfaces provide consistent pressure redistribution without mechanical movement. In surgical settings, the use of appropriate pressure-relieving devices for high-risk patients has been shown to significantly reduce the incidence of postoperative pressure ulcers (McInnes et al., 2015). Additionally, medical-grade sheepskins have demonstrated effectiveness in reducing pressure ulcer development by lowering localized pressure and improving microclimate conditions.

### ***Dynamic devices***

Dynamic support surfaces, including alternating-pressure and constant low-pressure systems, continuously change the area of support to prevent prolonged pressure on any single region. Although the comparative effectiveness of these two systems remains uncertain, alternating-pressure mattresses appear to be more cost-effective in the United Kingdom than alternating-pressure overlays (McInnes et al., 2015).

Dynamic surfaces are particularly suitable for patients who are unable to reposition themselves independently or who have poorly healing ulcers (Whitney et al., 2006). A practical indicator of surface adequacy is the “one-inch rule”: if there is less than one inch of material between the patient’s ulcer and the underlying bed surface, the device may be ineffective and should be replaced with an alternative (Whitney et al., 2006).

### ***Additional pressure-relieving devices***

Other pressure-relieving aids include chair cushions, pillows, foam wedges, and specialized materials used to offload pressure from vulnerable areas such as the heels or between the knees. However, ring cushions should be avoided, as they can concentrate pressure around their edges and potentially worsen tissue damage.

### ***Repositioning and pressure redistribution***

Regular repositioning remains a cornerstone of pressure ulcer prevention and management, as it relieves prolonged pressure, reduces shear and friction forces, and promotes tissue perfusion. According to the EPUAP, NPIAP, & PPPIA (2019) clinical practice guidelines, all individuals at risk of pressure ulcers should have a personalized repositioning schedule based on their level of mobility, skin tolerance, support surface used, perfusion status, and overall medical condition. Although the traditional two-hourly repositioning rule has been widely adopted in clinical practice, there is no single evidence-based standard frequency that applies universally to all patients EPUAP, NPIAP, & PPPIA (2019).

Current evidence indicates that repositioning frequency should be individualized and may range from every two to four hours when using standard mattresses, to less frequent intervals when patients are placed on advanced pressure-redistributing or alternating air surfaces (Gillespie et al., 2020). The decision should be guided by ongoing skin assessments particularly over bony prominences such as

the sacrum and heels and by monitoring for early signs of tissue compromise.

When repositioning, clinicians should minimize shear and friction by limiting the elevation of the head of the bed to 30 degrees or less, unless contraindicated by medical conditions such as respiratory distress or risk of aspiration (Whitney et al., 2006; EPUAP, NPIAP, & PPPIA 2019). The 30° lateral tilt or other offloading positions are recommended to redistribute pressure away from vulnerable areas while maintaining patient comfort and safety.

### ***Integrated preventive considerations***

In addition to mechanical pressure relief, comprehensive preventive strategies should address nutritional status and skin integrity. While malnutrition is recognized as a risk factor for pressure ulcer development, the evidence does not yet confirm a direct causal relationship (Thomas, 2006). Therefore, a holistic prevention plan should integrate nutritional assessment, skin care management, and appropriate use of pressure-relieving devices

### **Wound cleansing and infection management**

Wound cleansing is a fundamental component of pressure ulcer management and should be performed initially and at every dressing change to remove debris, exudate, and surface contaminants. The EPUAP, NPIAP, & PPPIA (2019) guidelines recommend cleansing with a neutral, non-cytotoxic solution, with normal saline or potable tap water

preferred, due to their safety and tissue compatibility (Shuk-Fan et al., 2016). Using a 35-mL syringe with a 19-gauge angio-catheter provides an optimal irrigation pressure (approximately 8 psi) that effectively removes debris without damaging granulation tissue. The use of antiseptic agents such as povidone-iodine, hydrogen peroxide, and acetic acid should be avoided, as these agents are cytotoxic and can delay epithelialization and wound healing (Shuk-Fan et al., 2016; EPUAP, NPIAP, & PPPIA, 2019).

Synthetic dressings, such as transparent films, hydrogels, alginates, foams, and hydrocolloids, offer a moist wound environment, reduce caregiver time, and promote patient comfort (Westby et al., 2017). Dressing selection should be based on the wound's moisture balance, depth, and presence of infection or exudate.

### ***Antimicrobial and antibiotic management***

According to the EPUAP, NPIAP, & PPPIA (2019) and NICE (2014) guidelines, the presence of bacterial colonization in pressure ulcers is expected and does not, by itself, indicate infection. Antimicrobial therapy should therefore be guided by clinical signs of infection rather than routine swabbing.

Topical antimicrobial therapy (e.g., silver sulfadiazine, silver-impregnated dressings, or iodine-based dressings) may be appropriate in locally infected or critically colonized wounds—those characterized by delayed healing, increased exudate, malodor, or friable granulation tissue without systemic signs of infection

(Bhattacharya & Mishra, 2015; EPUAP, NPIAP, & PPPIA, 2019). A short course (up to 2 weeks) of topical antimicrobial treatment is recommended. If no improvement occurs, the dressing should be discontinued, and further investigation for deeper infection should be initiated (NICE, 2014).

Systemic antibiotic therapy should be reserved for cases with spreading cellulitis, osteomyelitis, bacteremia, or systemic inflammatory response (EPUAP, NPIAP, & PPPIA, 2019; Whitney et al., 2006). Indications include rapidly increasing erythema, warmth, or tenderness extending beyond the wound margins, systemic symptoms such as fever, leukocytosis, or hypotension, positive blood cultures, or radiologic or histologic evidence of osteomyelitis.

In suspected deep tissue infection or osteomyelitis, diagnostic confirmation should be obtained through quantitative tissue biopsy or needle aspiration, which are preferred over superficial swabs for microbiological accuracy (EPUAP, NPIAP, & PPPIA, 2019). The use of systemic antibiotics in uninfected pressure ulcers is not recommended, as it does not enhance healing and may contribute to antimicrobial resistance (EPUAP, NPIAP, & PPPIA, 2019; NICE, 2014).

### ***Pain management***

Pain assessment should be completed, especially during repositioning, dressing changes, and debridement. Patients at the highest risk of pressure ulcers may not have full sensation or may require alternate pain

assessment tools to aid in communication. the goal is to eliminate pain by covering the wound, adjusting pressure-reducing surfaces, repositioning the patient, and providing topical or systemic analgesia. small randomized controlled trials show that topical opioid (diamorphine gel; not available in the United States) and nonopioid (lidocaine/ prilocaine [EMLA]) preparations reduce pain during dressing changes and debridement (Bhattacharya & Mishra, 2015).

### ***Infection control***

Pressure ulcers are invariably colonized with bacteria; however, wound cleansing and debridement minimize bacterial load. A trial of topical antibiotics, such as silver sulfadiazine cream (Silvadene), should be used for up to two weeks for clean ulcers that are not healing properly after two to four weeks of optimal wound care. Quantitative bacteria tissue cultures should be performed for nonhealing ulcers after a trial of topical antibiotics or if there are signs of infection (e.g., increased drainage, odor, surrounding erythema, pain, warmth). A superficial swab specimen may be used; however, a needle aspiration or ulcer biopsy (preferred) is more clinically significant. Systemic antibiotics are not recommended unless there is evidence of advancing cellulitis, osteomyelitis, and bacteremia. ulcers are difficult to resolve (Bhattacharya & Mishra, 2015).

### ***Advanced treatment options***

Pressure ulcers require a multifaceted approach to management and treatment, incorporating both traditional and

innovative strategies (Bhattacharya & Mishra, 2015). Preventive measures are crucial and include the use of pressure relief devices such as specialized mattresses and cushions. Nutrition also plays a significant role in the prevention and healing of pressure ulcers, particularly in elderly and diabetic patients (Iizaka et al., 2010).

### ***Wound care and debridement***

Effective wound care involves cleaning and debridement to remove necrotic tissue, which promotes bacterial growth and impairs healing. Debridement methods vary depending on the wound's characteristics (Shuk-Fan et al., 2016; Stephenson et al., 2021).

**Sharp Debridement:** Is performed with a sterile scalpel or scissors, often at the bedside or in the operating room for extensive cases. Sharp debridement is necessary for infected wounds or thick eschar and requires adequate vascularization. However, it is contraindicated in patients on anticoagulation therapy (Nakagami et al., 2020).

**Mechanical Debridement:** It includes wet-to-dry dressings, hydrotherapy, wound irrigation, and whirlpool bath debridement. While effective, this method can be painful and may inadvertently remove viable tissues (Nakagami et al., 2020).

**Enzymatic Debridement:** An efficient substitute for eliminating necrotic material

from pressure ulcers, leg ulcers, and partial-thickness wounds is to use enzymatic debriding chemicals. They can be utilized to debride eschar and adhering slough. In some situations, enzymatic agents may be the main debridement strategy, particularly when other approaches, including surgery or conservative sharp wound debridement (CSWD), are impractical due to bleeding disorders or other factors (Ramundo & Gray 2008).

### **Monitoring and documentation**

Regular monitoring and documentation of the patient's condition are essential to evaluate the effectiveness of interventions and make necessary adjustments. Studies have shown that systematic documentation by nursing staff is crucial, as physicians often underreport pressure ulcers (Backman et al., 2016). Continuous education and training for healthcare providers are also necessary to maintain high standards of care and improve patient outcomes (Bulut et al., 2022).

### **Recommendations for practical implications**

Based on the results of the review, the following recommendations and practical implications are summarised (Table 1).

### **Limitations**

This review has several limitations. First, the literature search was restricted to

**Table 1: Summary of evidence-based recommendations and practical implications for clinicians in pressure ulcer management**

| Key domain                    | Evidence-based recommendations                                                                                                                                                              | Practical implications for healthcare professionals                                                                                                                      |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Risk assessment            | Use validated tools such as the <i>Braden</i> , <i>Waterlow</i> , <i>Norton</i> , or <i>Braden Q</i> Scales alongside clinical judgment (Barker et al., 2013; Lospitao-Gómez et al., 2017). | Conduct comprehensive pressure ulcer risk assessments on admission, regularly during hospitalization, and before discharge. Reassess promptly after any clinical change. |
| 2. Skin and tissue assessment | Perform thorough inspection focusing on bony prominences (sacrum, heels, trochanters); for neonates, assess the occiput (NPUAP, EPUAP, NPIAP, & PPPIA, 2014).                               | Examine high-risk areas daily; document findings and initiate preventive measures immediately if early damage is detected.                                               |
| 3. Preventive skin care       | Maintain skin integrity through gentle cleansing with pH-balanced cleansers and regular use of emollients or moisturizers (Haesler, 2018; Shannon et al., 2009).                            | Establish structured skin care protocols, including cleansing, moisturizing, and routine skin assessments as part of nursing care plans.                                 |
| 4. Moisture management        | Control excess moisture from incontinence, perspiration, or wound exudate using high-absorbency pads, fecal management systems, and barrier creams (Gray et al., 2011)                      | Implement individualized continence management plans; apply barrier products consistently and monitor skin condition daily.                                              |
| 5. Avoidance of massage       | Massage does not prevent PUs and may cause tissue injury (Duimel-Peeters et al., 2007; Haesler, 2018).                                                                                      | Educate staff to avoid vigorous rubbing or massaging of reddened areas; instead, use pressure redistribution strategies.                                                 |
| 6. Low-friction textiles      | Use low-friction coefficient fabrics for bedding and garments to reduce shear and friction (Smith et al., 2013; Yusuf et al., 2015).                                                        | Replace conventional linens with silk-like low-friction materials, especially for immobile or high-risk patients.                                                        |
| 7. Prophylactic dressings     | Apply silicone foam, hydrocolloid, or film dressings to high-risk sites such as heels and sacrum (Yoshimura et al., 2018).                                                                  | Incorporate prophylactic dressings into routine prevention protocols, particularly for surgical or device-related pressure points.                                       |
| 8. Nutrition and hydration    | Ensure adequate intake of macro- and micronutrients and fluids to support tissue repair and healing (Kennerly et al., 2015; Iizaka et al., 2010).                                           | Screen all patients for malnutrition; collaborate with dietitians to optimize nutritional and hydration status.                                                          |
| 9. Pressure redistribution    | Use pressure-reducing devices (static or dynamic surfaces) to maintain tissue perfusion (McInnes et al., 2015; Whitney et al., 2006).                                                       | Select appropriate support surfaces based on patient mobility and ulcer stage; regularly check for “bottoming out.”                                                      |
| 10. Repositioning             | Regular repositioning alleviates pressure and promotes circulation (Whitney et al., 2006).                                                                                                  | Turn bedridden patients at least every 2 hours or as clinically appropriate; avoid head-of-bed elevation >30°.                                                           |

|                                  |                                                                                                                                         |                                                                                                                           |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| 11. Wound care and debridement   | Cleanse wounds with normal saline and debride necrotic tissue using appropriate methods (Shuk-Fan et al., 2016; Nakagami et al., 2020). | Use evidence-based wound cleansing and dressing protocols; avoid cytotoxic antiseptics; ensure timely debridement.        |
| 12. Pain management              | Address pain during repositioning, dressing changes, and debridement (Bhattacharya & Mishra, 2015).                                     | Utilize validated pain assessment tools; apply topical or systemic analgesics as needed.                                  |
| 13. Infection control            | Use topical or systemic antibiotics only when infection is present (Bhattacharya & Mishra, 2015).                                       | Perform regular wound surveillance; culture nonhealing ulcers and apply infection control protocols.                      |
| 14. Monitoring and documentation | Accurate recording improves care continuity and outcome evaluation (Backman et al., 2016; Bulut et al., 2022).                          | Maintain systematic documentation of assessments, interventions, and outcomes; engage in continuous education and audits. |

selected databases and may not have captured all relevant studies, particularly those indexed in other databases or unpublished sources. Only articles published in English were included, which may have introduced language bias and excluded valuable evidence from non-English publications. Second, a formal quality appraisal or risk of bias assessment was not conducted due to the narrative nature of the review and the heterogeneity of the included study designs. As a result, the methodological rigor of individual studies was not systematically evaluated. Third, the included studies varied considerably in terms of design, population characteristics, interventions, and outcome measures, limiting the ability to draw direct comparisons or perform quantitative synthesis. Finally, publication bias cannot be ruled out, as studies reporting positive or significant results are more likely to be published and indexed, potentially influencing the overall conclusions. Despite these limitations, the review provides a comprehensive synthesis of

current evidence and highlights key gaps to inform future research and clinical practice in pressure ulcer prevention and management.

## Conclusion

Effective pressure ulcer management requires a multidisciplinary, evidence-based approach integrating prevention, early detection, and individualized care. Systematic risk assessment using validated tools like the Braden, Waterlow, and Norton Scales enables timely interventions. Maintaining skin integrity through proper cleansing, moisturizing, and moisture control, along with the use of barrier products and prophylactic dressings, significantly reduces ulcer incidence. Nutritional optimization, hydration, and regular repositioning with pressure-redistributing devices are essential for prevention and healing. For existing ulcers, evidence supports comprehensive wound care, pain control, and infection prevention. Continuous monitoring, documentation, and staff education ensure consistent

implementation and quality improvement. Overall, integrating these strategies promotes better healing outcomes, enhances patient safety, and improves quality of care

### Funding statement

This study received no specific grant from any funding agency.

### Conflict of interest

The authors declared that they have no conflicts of interest.

### References

- Amêndoa, D., Gugg, L., Gomes, C., Diniz, C., Ferreira, O., & Baixinho, C. L. (2025). Intervention in healthcare teams to promote adherence to the integration of care for people at risk of pressure injuries between hospitals and communities: A scoping review. *International Wound Journal*, 22(9), e70212. <https://doi.org/10.1111/iwj.70212>
- Backman, C., Vanderloo, S. E., Miller, T. B., Freeman, L., & Forster, A. J. (2016). Comparing physical assessment with administrative data for detecting pressure ulcers in a large Canadian academic health sciences centre. *BMJ Open*, 6(10), e012490. <https://doi.org/10.1136/bmjopen-2016-012490>
- Barker, A. L., Kamar, J., Tyndall, T. J., White, L., Hutchinson, A., Klopfer, N., & Weller, C. (2013). Implementation of pressure ulcer prevention best practice recommendations in acute care: An observational study. *International Wound Journal*, 10(3), 313–320. <https://doi.org/10.1111/j.1742-481X.2012.00979.x>
- Bhattacharya, S., & Mishra, R. K. (2015). Pressure ulcers: Current understanding and newer modalities of treatment. *Indian Journal of Plastic Surgery*, 48(1), 4–16. <https://doi.org/10.4103/0970-0358.155260>
- Broussard, K. C., & Powers, J. G. (2013). Wound dressings: Selecting the most appropriate type. *American Journal of Clinical Dermatology*, 14(6), 449–459. <https://doi.org/10.1007/s40257-013-0046-4>
- Bulut, A., Aksu, Ç., Bulut, A., & Aslan, M. (2022). Investigating attitudes of nurses working in a state hospital towards the prevention of pressure ulcers. *Genel Tıp Dergisi*, 32(1), 5–11. <https://doi.org/10.54005/geneltip.975767>
- Chou, R., Dana, T., Bougatsos, C., Blazina, I., Starmer, A. J., Reitel, K., & Buckley, D. I. (2013). Pressure ulcer risk assessment and prevention: A systematic comparative effectiveness review. *Annals of Internal Medicine*, 159(1), 28–38. <https://doi.org/10.7326/0003-4819-159-1-201307020-00006>
- Coladonato, J., Smith, A., Watson, N., Brown, A. T., McNichol, L. L., Clegg, A., Griffin, T., McPhail, L., & Montgomery, T. G. (2012). Prospective, nonrandomized controlled trials to compare the effect of a silk-like fabric to standard hospital linens on the rate of hospital-acquired pressure ulcers.

- Ostomy/Wound Management*, 58(10), 14–31.
- Crunden, E. A., Schoonhoven, L., Coleman, S. B., & Worsley, P. R. (2022). Reporting of pressure ulcers and medical device-related pressure ulcers in policy and practice: A narrative literature review. *Journal of Tissue Viability*, 31(1), 119–129. <https://doi.org/10.1016/j.jtv.2021.10.010>
- Doh, G., & Heo, C. (2021). Pathogenesis and prevention of pressure ulcer. *Journal of Korean Medical Association*, 64(1), 16–25. <https://doi.org/10.5124/jkma.2021.64.1.16>
- Duimel-Peeters, I. G., Halfens, R. J. G., Ambergen, A. W., Houwing, R. H., Berger, M. P. F., & Snoeckx, L. H. (2007). The effectiveness of massage with and without dimethyl sulfoxide in preventing pressure ulcers: A randomized, double-blind crossover trial in patients prone to pressure ulcers. *International Journal of Nursing Studies*, 44(8), 1285–1295. <https://doi.org/10.1016/j.ijnurstu.2007.04.002>
- European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), & Pan Pacific Pressure Injury Alliance (PPPIA). (2019). *Prevention and treatment of pressure ulcers/injuries: Clinical practice guideline* (3rd ed.).
- Francis, K., Pang, S. M., Cohen, B., Salter, H., & Homel, P. (2017). Disposable versus reusable absorbent underpads for prevention of hospital-acquired incontinence-associated dermatitis and pressure injuries. *Journal of Wound, Ostomy & Continence Nursing*, 44(4), 374–379. <https://doi.org/10.1097/WON.0000000000000337>
- Garcia, A. D., & Thomas, D. R. (2006). Assessment and management of chronic pressure ulcers in the elderly. *Medical Clinics of North America*, 90(5), 925–944. <https://doi.org/10.1016/j.mcna.2006.05.018>
- Gillespie, B. M., Walker, R. M., Latimer, S. L., Thalib, L., Whitty, J. A., McInnes, E., & Chaboyer, W. P. (2020). Repositioning for pressure injury prevention in adults. *Cochrane Database of Systematic Reviews*, 6(6), CD009958. <https://doi.org/10.1002/14651858.CD009958.pub3>
- Gray, M., Beeckman, D., Bliss, D. Z., Fader, M., Logan, S., Junkin, J., Seleko, J., Doughty, D., & Kurz, P. (2012). Incontinence-associated dermatitis: A comprehensive review and update. *Journal of Wound, Ostomy & Continence Nursing*, 39(1), 61–74. <https://doi.org/10.1097/WON.0b013e31823fe246>
- Gunningberg, L., Mårtensson, G., Mamhidir, A., Florin, J., Muntlin Athlin, Å., & Bååth, C. (2015). Pressure ulcer knowledge of registered nurses, assistant nurses and student nurses: A descriptive, comparative multicentre study in Sweden. *International Wound Journal*, 12(4), 462–468. <https://doi.org/10.1111/iwj.12138>
- Haesler, E. (2018). *Evidence summary: Skin care to reduce the risk of pressure injuries*. Wound Healing and Management Node.

- Huang, C., Ma, Y., Wang, C., Jiang, M., Yuet Foon, L., Lv, L., & Han, L. (2021). Predictive validity of the Braden Scale for pressure injury risk assessment in adults: A systematic review and meta-analysis. *Nursing Open*, 8(5), 2194–2207. <https://doi.org/10.1002/nop2.792>
- Iizaka, S., Okuwa, M., Sugama, J., & Sanada, H. (2010). The impact of malnutrition and nutrition-related factors on the development and severity of pressure ulcers in older patients receiving home care. *Clinical Nutrition*, 29(1), 47–53. <https://doi.org/10.1016/j.clnu.2009.05.018>
- Kennerly, S., Batchelor-Murphy, M., & Yap, T. L. (2015). Clinical insights: Understanding the link between nutrition and pressure ulcer prevention. *Geriatric Nursing*, 36(6), 477–481. <https://doi.org/10.1016/j.gerinurse.2015.10.007>
- Li, Z., Lin, F., Thalib, L., & Chaboyer, W. (2020). Global prevalence and incidence of pressure injuries in hospitalised adult patients: A systematic review and meta-analysis. *International Journal of Nursing Studies*, 105, 103546. <https://doi.org/10.1016/j.ijnurstu.2020.103546>
- Lospitao-Gómez, S., Sebastián-Viana, T., González-Ruiz, J. M., & Álvarez-Rodríguez, J. (2017). Validity of the current risk assessment scale for pressure ulcers in intensive care (EVARUCI) and the Norton-MI scale in critically ill patients. *Applied Nursing Research*, 38, 76–82. <https://doi.org/10.1016/j.apnr.2017.09.004>
- Mahmoodpoor, A., Shadvar, K., Saghaleini, S., Dehghan, K., & Ostadi, Z. (2018). Pressure ulcer and nutrition. *Indian Journal of Critical Care Medicine*, 22(4), 283–289. [https://doi.org/10.4103/ijccm.IJCCM\\_277\\_17](https://doi.org/10.4103/ijccm.IJCCM_277_17)
- Mahran, G., Ahmed, N., Bakri, M., & Aziz, M. (2024). Effect of the “aSSKING” model in reducing pressure ulcer risk. *Critical Care Nursing Quarterly*, 47(4), 322–334. <https://doi.org/10.1097/cnq.0000000000000520>
- McInnes, E., Jammali-Blasi, A., Bell-Syer, S. E., Dumville, J. C., Middleton, V., & Cullum, N. (2015). Support surfaces for pressure ulcer prevention. *Cochrane Database of Systematic Reviews*, 2015(9). <https://doi.org/10.1002/14651858.CD001735.pub5>
- Mizokami, F., Furuta, K., & Isogai, Z. (2014). Necrotizing soft tissue infections developing from pressure ulcers. *Journal of Tissue Viability*, 23(1), 1–6. <https://doi.org/10.1016/j.jtv.2013.11.001>
- Nakagami, G., Schultz, G., Kitamura, A., Minematsu, T., Akamata, K., Suga, H., Kurita, M., Hayashi, C., & Sanada, H. (2020). Rapid detection of biofilm by wound blotting following sharp debridement of chronic pressure ulcers predicts wound healing: A preliminary study. *International Wound Journal*, 17(1), 191–196. <https://doi.org/10.1111/iwj.13256>
- National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel, & Pan Pacific Pressure Injury Alliance. (2014). *Prevention and treatment of pressure ulcers: Clinical*

- practice guideline (E. Haesler, Ed.). Cambridge Media.
- NICE. (2023). *Pressure ulcers: Prevention and management (NG179)*. National Institute for Health and Care Excellence.
- O'Connor, T., Moore, Z. E., & Patton, D. (2021). Patient and lay carer education for preventing pressure ulceration in at-risk populations. *Cochrane Database of Systematic Reviews*, 2021(3). <https://doi.org/10.1002/14651858.CD012006.pub2>
- Park, K. H., & Kim, K. S. (2014). Effect of a structured skin care regimen on patients with fecal incontinence: A comparison cohort study. *Journal of Wound, Ostomy, and Continence Nursing*, 41(2), 161–167. <https://doi.org/10.1097/WON.0000000000000005>
- Ramundo, J., & Gray, M. (2008). Enzymatic wound debridement. *Journal of Wound, Ostomy, and Continence Nursing*, 35(3), 273–280. <https://doi.org/10.1097/01.WON.0000319125.21854.78>
- Shannon, R. J., Brown, L., & Chakravarthy, D. (2012). Pressure ulcer prevention program study: A randomized, controlled, prospective comparative value evaluation of two pressure ulcer prevention strategies in nursing and rehabilitation centers. *Advances in Skin & Wound Care*, 25(10), 450–464. <https://doi.org/10.1097/01.ASW.0000421461.21773.32>
- Shuk-Fan, T., Joanne, Y., Kit-Lun, Y., & Marcus Chun-Wah, Y. (2016). Pressure ulcer wound care for elderly in home: A case report. *Journal of Dermatology Research and Therapy*, 2(3). <https://doi.org/10.23937/2469-5750/1510028>
- Song, Y., Ban, K., Kim, H., Kim, S., Park, S., & Kwon, M. (2023). Development of pressure ulcer management and fall prevention protocol. *Journal of Korean Academy of Fundamentals of Nursing*, 30(3), 391–403. <https://doi.org/10.7739/jkafn.2023.30.3.391>
- Smith, A., McNichol, L. L., Amos, M. A., Mueller, G., Griffin, T., Davis, J., McPhail, L., & Montgomery, T. G. (2013). A retrospective, nonrandomized, before-and-after study of the effect of linens constructed of synthetic silk-like fabric on pressure ulcer incidence. *Ostomy/Wound Management*, 59(4), 28–34.
- Smith, G., & Ingram, A. (2010). Clinical and cost-effectiveness evaluation of low-friction and shear garments. *Journal of Wound Care*, 19(12), 535–542. <https://doi.org/10.12968/jowc.2010.19.12.535>
- Stephenson, J., Fletcher, J., Parfitt, G., & Ousey, K. (2021). National audit of pressure ulcer prevalence in England: A cross-sectional study. *Wounds UK*, 17(4).
- Thomas, D. R. (2006). Prevention and treatment of pressure ulcers. *Journal of the American Medical Directors Association*, 7(1), 46–59. <https://doi.org/10.1016/j.jamda.2005.10.004>
- Torra i Bou, J. E., Segovia Gómez, T., Verdú Soriano, J., Nolasco Bonmatí, A., Rueda López, J., & Arboix i Perejamo, M. (2005). The

- effectiveness of a hyperoxygenated fatty acid compound in preventing pressure ulcers. *Journal of Wound Care*, 14(3), 117–121. <https://doi.org/10.12968/jowc.2005.14.3.26752>
- Vera-Salmerón, E., Mota-Romero, E., Romero-Béjar, J. L., Dominguez-Nogueira, C., & Gómez-Pozo, B. (2022). Pressure ulcers risk assessment according to nursing criteria. *Healthcare*, 10(8), 1438. <https://doi.org/10.3390/healthcare10081438>
- Verdú, J., & Soldevilla, J. (2012). IPARZINE-SKR study: Randomized, double-blind clinical trial of a new topical product versus placebo to prevent pressure ulcers. *International Wound Journal*, 9(5), 557–565. <https://doi.org/10.1111/j.1742-481x.2011.00918.x>
- Twersky, J., Montgomery, T., Sloane, R., Weiner, M., Doyle, S., Mathur, K., Francis, M., & Schmader, K. (2012). A randomized, controlled study to assess the effect of silk-like textiles and high-absorbency adult incontinence briefs on pressure ulcer prevention. *Ostomy/Wound Management*, 58(12), 18–24.
- Wahyuni, E., Dewi, Y., Laili, N., Kurniawati, N., Wulandari, S., Gunawan, G., & Lestari, D. (2023). A systematic review of pressure ulcers prevention. *Fundamental and Management Nursing Journal*, 6(1), 7–17. <https://doi.org/10.20473/fmnj.v6i1.41956>
- Westby, M. J., Dumville, J. C., Soares, M. O., Stubbs, N., & Norman, G. (2017). Dressings and topical agents for treating pressure ulcers. *Cochrane Database of Systematic Reviews*. <https://doi.org/10.1002/14651858.CD011947.pub2>
- Whitney, J., Phillips, L., Aslam, R., Barbul, A., Gottrup, F., Gould, L., Robson, M. C., Rodeheaver, G., Thomas, D., & Stotts, N. (2006). Guidelines for the treatment of pressure ulcers. *Wound Repair and Regeneration*, 14(6), 663–679. <https://doi.org/10.1111/j.1524-475X.2006.00175.x>
- Yoshimura, M., Ohura, N., Tanaka, J., Ichimura, S., Kasuya, Y., Hotta, O., Kagaya, Y., Sekiyama, T., Tannba, M., & Suzuki, N. (2018). Soft silicone foam dressing is more effective than polyurethane film dressing for preventing intraoperatively acquired pressure ulcers in spinal surgery patients: The Border Operating Room Spinal Surgery (BOSS) trial in Japan. *International Wound Journal*, 15(2), 188–197. <https://doi.org/10.1111/iwj.12696>
- Yusuf, S., Okuwa, M., Shigeta, Y., Dai, M., Iuchi, T., Rahman, S., Usman, A., Kasim, S., Sugama, J., Nakatani, T., & Sanada, H. (2015). Microclimate and development of pressure ulcers and superficial skin changes. *International Wound Journal*, 12(1), 40–46. <https://doi.org/10.1111/iwj.12048>
- Zambonato, B. P., Assis, M. C. S. de, & Beghetto, M. G. (2013). Associação das sub-escalas de Braden com o risco do desenvolvimento de úlcera por pressão. *Revista Gaúcha de Enfermagem*, 34(2), 21–28.