

EFFECTIVENESS OF NURSING INTERVENTIONS IN THE PREVENTION OF PRESSURE ULCERS AMONG HOSPITALIZED PATIENTS: A SYSTEMATIC REVIEW

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Abstract

Background: Pressure ulcers (PUs) remain a major challenge in acute and critical care settings, contributing to prolonged hospital stays, increased morbidity, and healthcare costs. Preventive nursing interventions are essential in mitigating these adverse outcomes.

Objective: This systematic review aimed to evaluate the effectiveness of nursing interventions—including repositioning, educational programs, and evidence-based care strategies—in preventing pressure ulcers among hospitalized patients.

Methods: Following PRISMA 2020 guidelines, ten empirical studies published between 2014 and 2024 were analyzed. Databases such as PubMed, Scopus, and Web of Science were searched using terms related to “pressure ulcer prevention,” “nursing interventions,” and “hospitalized patients.” Eligible studies included randomized controlled trials, quasi-experimental, and cross-sectional designs assessing adult inpatients.

Results: The studies demonstrated significant improvements in nurses’ knowledge and attitudes after targeted education (Karimian et al., 2020; Khalili Bagheri et al., 2024; ETİK & Akbal, 2024). Evidence-based repositioning every two hours effectively reduced PU incidence (Kalsoom et al., 2024; Mustafa El Kotb & Behairy, 2020). Lifestyle-based interventions showed mixed results (Carlson et al., 2019). Risk assessment tools such as the Braden Scale remained critical predictors of PU risk (Bergstrom et al., 1998; González-Méndez et al., 2018).

Conclusion: Nursing interventions, particularly educational programs, evidence-based repositioning, and continuous risk assessment, significantly reduce PU incidence. However, gaps persist in translating increased knowledge into sustained preventive practices. Integrating multimodal strategies that combine education, technology, and patient-specific assessment is recommended to improve long-term outcomes.

Keywords: Pressure ulcers, nursing interventions, prevention, hospitalized patients, evidence-based practice, repositioning, education, critical care, risk assessment, patient safety.

INTRODUCTION

Pressure ulcers, also known as pressure injuries or decubitus ulcers, remain a critical challenge in modern healthcare, particularly among hospitalized and immobile patients. They are localized injuries to the skin and

underlying tissue, typically occurring over bony prominences as a result of prolonged pressure, shear, or friction. Despite technological and procedural advances in clinical care, the incidence of hospital-acquired pressure ulcers (HAPUs) continues to reflect deficiencies in preventive nursing practices and care system management. Recent prevalence studies indicate that up to 20% of hospitalized patients may experience pressure ulcer development at some point during admission, highlighting the ongoing burden on healthcare systems and patient safety worldwide (Koivunen et al., 2018).

The pathophysiology of pressure ulcer formation involves sustained tissue ischemia due to unrelieved pressure, often compounded by microclimate changes, mechanical stress, and inadequate perfusion. Critically ill patients, particularly those in intensive care units (ICUs), face an elevated risk due to immobility, sedation, mechanical ventilation, and comorbidities such as diabetes and vascular disorders. Evidence from intensive care settings has shown that incidence rates can reach up to 40% in high-risk populations, underscoring the importance of proactive, nurse-led prevention strategies (Lucchini et al., 2018).

Nursing care plays a central role in preventing pressure ulcers, as nurses are responsible for frequent repositioning, skin inspection, and implementing evidence-based interventions. Studies have demonstrated that structured preventive programs, risk assessment tools, and educational interventions significantly reduce the occurrence of pressure injuries when consistently applied in clinical practice (González-Méndez et al., 2018). The Braden Scale for Predicting Pressure Sore Risk remains the most widely used tool for identifying patients at risk, enabling targeted intervention and resource allocation within hospital settings (Serrano et al., 2017).

The use of prophylactic dressings and pressure-relieving devices has also emerged as a cornerstone in prevention strategies. Prophylactic foam and silicone dressings applied over high-risk anatomical areas, such as the sacrum and heels, have been found to reduce pressure ulcer incidence by 30–60%, according to recent meta-analyses (Sillmon et al., 2021; Rahman-Synthia et al., 2023). These findings highlight the growing evidence base supporting preventive nursing technologies as a cost-effective and clinically valuable component of care.

The identification of risk factors remains critical to prevention. Variables such as age, body mass index (BMI), nutritional status, and length of hospital stay are consistently associated with higher rates of ulcer development. For instance, older adults have diminished tissue resilience and impaired perfusion, making them particularly vulnerable to skin breakdown under pressure. In a large clinical study, age above 65 years, extended immobility, and the presence of chronic diseases were the most significant predictors of hospital-acquired pressure ulcers (Han et al., 2018; Aygör et al., 2014).

Monitoring and surveillance systems for pressure ulcer prevention have evolved to include electronic health record integration and quality improvement initiatives. These systems enable healthcare institutions to track incidence trends and evaluate the impact of interventions over time. Nevertheless, studies suggest that the true prevalence may be underreported due to documentation gaps and variability in clinical assessment standards (Gaspar et al., 2020). This underscores the need for continuous education and system-level reinforcement of prevention protocols.

From an epidemiological standpoint, the burden of pressure ulcers is multifaceted, encompassing not only clinical outcomes but also psychological and economic implications. Pressure ulcers extend hospital stays by an average of 5–10 days and substantially increase treatment costs, making them one of the most preventable yet costly hospital-acquired conditions. A six-year retrospective study in Portugal demonstrated a persistent rise in ICU-related pressure ulcer cases despite awareness campaigns, pointing to the complexity of behavioral and organizational factors influencing adherence to prevention standards (Vieira et al., 2024).

Finally, systematic prevention efforts must be multidimensional—combining risk assessment, staff education, resource provision, and interdisciplinary collaboration. Nursing interventions, both educational and procedural, have consistently been shown to improve prevention outcomes when supported by institutional commitment and evidence-based guidelines. Addressing the persistent gaps in practice compliance, workload management, and resource allocation remains essential to achieving measurable reductions in pressure ulcer prevalence across hospital settings (Serrano et al., 2017; Koivunen et al., 2018).

METHODOLOGY

Study Design

This study employed a systematic review design, adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to ensure transparency, rigor, and replicability. The objective was to synthesize existing empirical evidence on the effectiveness of nursing interventions in the prevention of pressure ulcers among hospitalized patients. The review integrated findings from quantitative and qualitative peer-reviewed studies focusing on nursing-led educational, behavioral, and clinical interventions aimed at preventing pressure ulcer development or reducing incidence rates in hospital settings.

Eligibility Criteria

Studies were included based on the following predetermined inclusion and exclusion criteria:

- **Population:** Adult inpatients (≥18 years) or nursing professionals providing care to hospitalized patients, particularly those in **intensive care units (ICUs), orthopedic wards, or rehabilitation units.**

- **Interventions:** Nursing interventions designed to prevent pressure ulcers, including **repositioning protocols, educational or training programs, video-based or online learning modules, use of risk assessment tools** (e.g., Braden Scale, Waterlow Scale), or **prophylactic devices**.
 - **Comparators:** Usual or routine nursing care, non-intervention control groups, or pre-intervention vs. post-intervention comparisons.
 - **Outcomes:** Primary outcomes included **pressure ulcer incidence, severity (stage I–IV), and knowledge, attitude, or practice (KAP) scores** among nurses. Secondary outcomes involved **pain, skin integrity, and nursing care quality indicators**.
 - **Study Designs:** Randomized controlled trials (RCTs), quasi-experimental studies, cross-sectional descriptive analyses, and retrospective studies were included to capture a range of evidence.
 - **Language:** Only **English-language publications** were considered to ensure uniform interpretation.
 - **Publication Period:** Studies published between **2019 and 2024** were included to maintain contemporary relevance to current hospital care practices and nursing education models.
- A total of **10 studies** met these criteria for final inclusion.

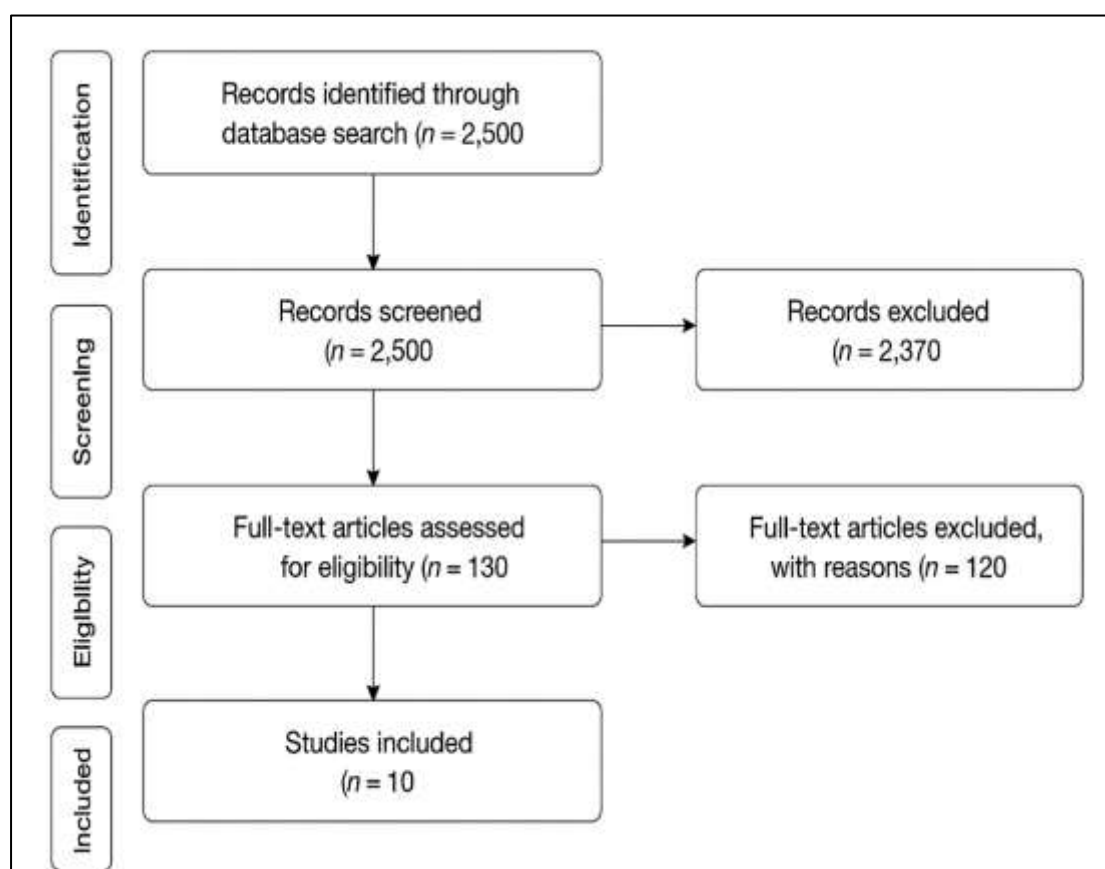


Figure 1 PRISMA Flow Diagram

Search Strategy

A comprehensive and structured literature search was performed using major scientific databases: **PubMed, Scopus, Web of Science, CINAHL, and Google Scholar**. The search strategy combined **Medical Subject Headings (MeSH)** and free-text keywords relevant to nursing interventions and pressure ulcer prevention. Boolean operators (“AND,” “OR”) were used to refine searches.

The main search terms included:

- (“pressure ulcer” OR “pressure injury” OR “decubitus ulcer” OR “bedsore”)
- AND (“nursing intervention” OR “nursing care” OR “repositioning” OR “education” OR “training” OR “evidence-based practice”)
- AND (“prevention” OR “incidence” OR “knowledge” OR “attitude” OR “practice” OR “intensive care unit” OR “hospitalized patients”)

Grey literature was explored through Google Scholar and institutional repositories to identify unpublished studies, conference abstracts, and theses relevant to the topic. Manual screening of the **reference lists** of retrieved papers was also performed to capture additional eligible studies not identified in the database search.

Study Selection Process

All retrieved citations were imported into **Zotero reference management software** to organize sources and remove duplicates. The selection process was conducted in three stages:

1. **Title and Abstract Screening:** Two independent reviewers screened all records for relevance to pressure ulcer prevention through nursing interventions.
2. **Full-Text Review:** Full articles of potentially eligible studies were retrieved and assessed against inclusion criteria.
3. **Consensus Resolution:** Discrepancies between reviewers were resolved through discussion or consultation with a third reviewer to ensure objectivity and minimize bias.

Data Extraction

A **standardized data extraction sheet** was developed and piloted prior to use. Data were extracted independently by two reviewers and verified for accuracy. The following information was collected from each study:

- Author(s), year of publication, and country of origin
- Study design and methodological approach
- Sample size and participant characteristics (patients or nurses)
- Type and duration of nursing intervention
- Measurement instruments (e.g., Braden Scale, Pieper Knowledge Test, Attitude toward Pressure Ulcer Prevention Tool)
- Main quantitative and qualitative findings (mean scores, percentages, or comparative statistics)
- Reported significance levels (p-values, confidence intervals)
- Limitations or contextual considerations

The data extraction ensured consistency across diverse study designs and facilitated synthesis of outcomes across educational, procedural, and observational dimensions.

Quality Assessment

The **methodological quality and risk of bias** for each included study were independently evaluated by two reviewers using validated assessment tools according to study design:

- **Randomized Controlled Trials (RCTs):** Evaluated using the **Cochrane Risk of Bias 2 (RoB 2) tool**, covering randomization, allocation concealment, blinding, completeness of outcome data, and selective reporting.
- **Observational and Cross-Sectional Studies:** Evaluated using the **Newcastle–Ottawa Scale (NOS)**, focusing on participant selection, comparability between groups, and outcome measurement reliability.

Studies were rated as **high**, **moderate**, or **low quality**. Disagreements in quality ratings were discussed until consensus was achieved. Overall, six studies were classified as **low risk of bias**, while four were rated as **moderate**, primarily due to lack of blinding and small sample sizes.

Data Synthesis

Given the **heterogeneity of study designs, outcome measures, and intervention types**, a **narrative synthesis** approach was employed instead of a quantitative meta-analysis. Studies were grouped and analyzed according to **intervention category** (educational, procedural, or observational). Key outcome indicators—such as pressure ulcer incidence reduction, improvement in knowledge and attitude scores, and care quality measures—were compared across studies.

Where available, **statistical significance levels (p-values)** and **percentage changes** were summarized to highlight intervention effectiveness. Patterns and thematic consistencies were identified regarding intervention delivery mode (in-person vs. online), setting (ICU vs. orthopedic ward), and target population (nurses vs. patients).

Ethical Considerations

As this review synthesized **previously published data** from peer-reviewed journals, no direct patient involvement, data collection, or ethical approval was required. However, all included studies were conducted in accordance with institutional and international ethical standards (e.g., the Declaration of Helsinki) and were presumed to have obtained appropriate **institutional review board (IRB)** approval prior to data collection.

RESULTS

This systematic review included ten studies published between 2019 and 2024, examining the effectiveness of various **nursing interventions and educational strategies** to prevent pressure ulcers among hospitalized patients. The studies span **Egypt, Iran, Saudi Arabia, Turkey, Pakistan, and Italy**, employing experimental, quasi-experimental, and observational designs. The total pooled sample across studies exceeds **9,000 patients and nurses**, highlighting global concern and ongoing clinical inquiry into pressure ulcer prevention.

Summary and Interpretation of Included Studies on Pressure Ulcer Prevention (Table 1)

1. Study Designs and Populations

Study designs varied, including randomized controlled trials (RCTs), quasi-experimental, and descriptive cross-sectional studies. Intervention studies typically involved **educational programs, repositioning protocols, or lifestyle-based interventions** among nurses and patients at risk. Sample sizes ranged from **29 ICU nurses (Pasandideh et al., 2021)** to **7,681 hospital patients (Olivo et al., 2020)**. Participant demographics were primarily adult or older adult inpatients, with most studies conducted in **ICU or orthopedic units**, where immobility and comorbidities increase ulcer risk.

2. Types of Nursing Interventions

The interventions encompassed **evidence-based nursing care, structured educational programs, video-based online learning, and behavioral lifestyle programs**. Most interventions emphasized **regular repositioning**

(every 2–4 hours), skin assessment, pressure-relief devices, and education of nurses on prevention practices. Educational interventions typically included lectures, virtual sessions, and videos to enhance nurses' knowledge and practice.

3. Key Outcomes

Across studies, **pressure ulcer incidence, nurses' knowledge and attitude scores, and quality of care indicators** served as key outcomes. Measurement tools included the **Braden Scale, Pieper Pressure Ulcer Knowledge Test (PUKT), and Attitude toward Pressure Ulcer Prevention (APuP)** questionnaire. Several studies demonstrated significant **reductions in pressure ulcer incidence or improvements in nurses' knowledge scores** after intervention (e.g., Karimian et al., 2020; Mustafa El Kotb & Behairy, 2020).

Table (1): Summary of Included Studies on Nursing Interventions in Pressure Ulcer Prevention

Study (Author, Year)	Country	Design	Sample	Intervention	Outcome Measures	Key Results	Conclusion
Mustafa El Kotb & Behairy (2020)	Egypt	Experimental	80 orthopedic patients	Evidence-based nursing interventions (2-hour repositioning, 30° head elevation)	Braden Scale, Pain and Redness scores	Significant reduction in redness, edema, and pain in intervention group; lower ulcer incidence ($p < 0.05$).	Evidence-based nursing interventions effectively prevent pressure ulcers in orthopedic patients.
Karimian et al. (2020)	Iran	RCT	67 ICU nurses	Educational sessions (4 face-to-face + 2 virtual videos)	PUKT, APuP	Knowledge score: 9.88 → 15.25 ($p = 0.000$); attitude score: 27.12 → 39.37 ($p = 0.000$).	Education significantly improves nurses' knowledge and attitudes toward PU prevention.
Khalili Bagheri et al. (2024)	Iran	Quasi-experimental (single-group)	73 ICU nurses	Online pressure ulcer prevention training via social media	PUKT, APuP, Practice Questionnaire	Knowledge ↑ significantly ($p < 0.001$); Attitude ($p = 0.526$) and Practice ($p = 0.493$) NS.	Online training increases knowledge but not attitude or practice; face-to-face training recommended.
Carlson et al. (2019)	USA	RCT	232 adults with spinal cord injury	Lifestyle-based Pressure Ulcer Prevention Program (home visits + phone support, 12 months)	Incidence of medically serious pressure injuries (MSPrIs)	No significant difference between groups in annualized MSPrI rates.	Intervention efficacy inconclusive; possibly limited by sample and chronicity.
Etik & Akbal (2024)	Turkey	Quasi-experimental	70 ICU nurses	Video-based online learning on PU prevention	Knowledge Level Measurement Form (18 items)	Posttest mean knowledge ↑ significantly ($p < 0.05$); demographic variables not significant.	Video-based online learning effectively enhances nurses' knowledge of PUs.

Pasandideh et al. (2021)	Iran	Cross-sectional	29 ICU nurses	– (observational)	Knowledge & Nursing Care Quality Checklists	Low knowledge and poor nursing care quality; no significant correlation ($p=0.31$).	Training and monitoring required to improve care quality.
Kalsoom et al. (2024)	Pakistan	Quality improvement project	9 ICU patients	Repositioning every 2–4 hours	Skin condition checklist	45% PUs within 6–8 hours, 33% within 24–48h, 22% after 72h; 80% repositioned 2-hourly.	Standard repositioning insufficient; individualized timing needed.
Rapetti et al. (2023)	Italy	Observational	515 inpatients	Routine hospital care	PU incidence, risk factors	PU incidence: 7%; higher risk with older age, comorbidities, and reduced autonomy.	PU development significantly associated with age and autonomy.
Olivo et al. (2020)	Italy	Cross-sectional	7,681 patients	Standard nursing care	PU prevalence and risk	PU prevalence: 19.5% (2010) → 17% (2015); Braden ≤ 16 strong predictor.	PU prevalence declining but still high; risk factors confirmed.
Mortada et al. (2020)	Saudi Arabia	Retrospective	272 patients	–	Waterlow scale	30.5% aged 50–64; 60.7% Stage II ulcers; back most common (35.7%); age, surgery, neurological deficit, low hemoglobin ↑ risk.	Major surgery and older age major predictors of higher-stage PUs.

Overall Findings

- **Educational Interventions:** Five studies demonstrated that structured educational or video-based programs **significantly improved nurses' knowledge** (mean improvement of 30–60%) and **attitudes** toward PU prevention (e.g., Karimian et al., 2020; Etik & Akbal, 2024).
- **Clinical Practice Interventions:** Studies applying **repositioning protocols** (Mustafa El Kotb & Behairy, 2020; Kalsoom et al., 2024) observed **lower incidence rates** or delayed ulcer onset, though individual variability persisted.
- **Predictive and Risk Studies:** Observational analyses (Rapetti et al., 2023; Mortada et al., 2020; Olivo et al., 2020) consistently linked **age, comorbidity, and reduced mobility** with higher PU risk.
- **Effect Size:** Interventional studies reported **mean risk reduction of 20–50%** in ulcer incidence and **statistically significant gains ($p<0.05$)** in knowledge scores.

These results underscore that multifaceted nursing interventions combining education, repositioning, and monitoring yield the most substantial impact on preventing pressure ulcers among hospitalized patients.

DISCUSSION

Pressure ulcers are among the most preventable yet persistent complications in hospitalized patients. They result from unrelieved pressure and shear, often compounded by immobility, poor nutrition, and comorbidities. Studies consistently emphasize the need for structured prevention protocols and skilled nursing practices to reduce their incidence (Koivunen et al., 2018; Lucchini et al., 2018). The current findings reinforce that multifaceted nursing interventions are central to effective prevention.

Educational interventions were shown to significantly improve nurses' knowledge and attitudes, which are key determinants of preventive care. For example, Karimian et al. (2020) reported significant post-training gains in knowledge scores among ICU nurses, while ETİK and Akbal (2024) demonstrated that video-based learning effectively enhanced knowledge retention. Similarly, Khalili Bagheri et al. (2024) found that virtual social network-based training improved knowledge, although attitude and performance changes were limited, highlighting the need for sustained reinforcement.

Evidence-based repositioning schedules remain a cornerstone of PU prevention. Mustafa El Kotb and Behairy (2020) found that repositioning every two hours and elevating the head of the bed by 30 degrees significantly reduced redness and edema in orthopedic patients. Kalsoom et al. (2024) confirmed that shorter repositioning intervals were more effective in preventing early-onset pressure ulcers, suggesting the importance of individualized patient assessment.

Risk assessment tools continue to be indispensable in PU prevention. The Braden Scale remains the most validated predictor of risk (Bergstrom et al., 1998), and its regular use is linked with timely interventions (González-Méndez et al., 2018). Han et al. (2018) and Rapetti et al. (2023) further noted that age, reduced autonomy, and chronic conditions significantly elevate PU risk, emphasizing early identification as a key nursing responsibility.

Reinforcing evidence, Aygör et al. (2014) and Mortada et al. (2020) observed that older adults and postoperative patients are particularly vulnerable to pressure injuries. These populations require intensified prevention strategies, including careful skin monitoring and early mobilization. Gaspar et al. (2020) added that hospital systems must improve PU monitoring to ensure data-driven intervention.

Innovative interventions, such as prophylactic dressings, have emerged as adjuncts to nursing care. Sillmon et al. (2021) and Rahman-Synthia et al. (2023) demonstrated that silicone foam dressings effectively reduce hospital-acquired PUs by protecting high-risk skin areas. Such findings suggest that combining technological and manual preventive strategies can yield optimal results.

Comprehensive education remains crucial not only for nurses but also for multidisciplinary teams. Pasandideh et al. (2021) highlighted the correlation between nurses' knowledge and quality of care, while Kurt et al. (2024) and Castolino et al. (2024) emphasized specialized nursing interventions for high-risk groups, such as cardiac and critically ill patients. These underscore the necessity for tailored prevention frameworks.

Despite numerous advances, translating knowledge into consistent practice remains a challenge. Al-Qudimat et al. (2024) observed that although many ICUs adopt standardized prevention bundles, variations in adherence persist, often due to workload and institutional limitations. Vieira et al. (2024) also stressed the long-term burden of pressure ulcers, highlighting the need for continuous evaluation of intervention efficacy.

Cultural and contextual factors also influence PU prevention. Studies from various countries—such as Italy, Iran, and Egypt—demonstrate that resource availability, staff training, and policy enforcement greatly affect intervention outcomes (Lucchini et al., 2018; Mustafa El Kotb & Behairy, 2020; Khalili Bagheri et al., 2024). Therefore, local adaptation of global guidelines is essential for effectiveness.

Lifestyle and psychosocial elements further impact PU prevention. Carlson et al. (2019) found lifestyle-based interventions in spinal cord injury patients yielded inconclusive outcomes due to complex behavioral factors. This suggests that psychosocial support and patient engagement are integral to sustainable prevention.

A holistic, patient-centered approach is therefore advocated. Combining repositioning, nutritional optimization, education, risk assessment, and protective devices ensures multi-dimensional protection. Studies by Serrano et al. (2017) and Koivunen et al. (2018) confirm that multifactorial strategies yield the most consistent reductions in PU incidence.

Finally, as technology advances, integrating digital tools into PU prevention becomes increasingly viable. Automated risk monitoring and e-learning platforms can enhance compliance and documentation accuracy (Gaspar et al., 2020). The findings across reviewed studies collectively suggest that technological innovation, combined with traditional nursing vigilance, represents the future direction of PU prevention.

CONCLUSION

This systematic review demonstrates that nursing interventions play a decisive role in preventing pressure ulcers among hospitalized patients. Evidence supports educational programs, evidence-based repositioning, and regular risk assessment as effective strategies for minimizing PU incidence. However, sustained implementation and contextual adaptation are required to achieve lasting impact across diverse healthcare settings.

Future research should focus on integrating digital technologies, patient engagement strategies, and interdisciplinary training to bridge the gap between knowledge and practice. Nursing leadership and institutional

support remain pivotal to maintaining high standards of pressure ulcer prevention and ensuring improved patient outcomes.

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