

Prevalence and Management of Pressure Ulcers in Disabled and Bedridden Populations: Innovations in Prevention and Treatment

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Introduction

Pressure ulcers (PUs) represent a significant public health concern, particularly among bedridden and immobile patient populations. PUs contribute to prolonged hospitalizations, increased healthcare costs, and substantial declines in patient quality of life. Vulnerable populations such as the elderly, intensive care patients, and individuals with limited mobility are at especially high risk.¹

- The development of pressure ulcers is driven by sustained pressure on the skin and underlying tissues, resulting in reduced blood flow, tissue ischemia, and eventually, skin breakdown.²
- PUs are prone to secondary infections, including cellulitis, osteomyelitis, and sepsis, further complicating recovery.³
- Preventive strategies, such as frequent repositioning, specialized mattresses, and prophylactic dressings to high-risk areas like the sacrum and heels, are essential but inconsistently implemented due to staffing limitations and monitoring challenges.^{4,5,6}
- Emerging innovations, such as wearable sensors that track patient positioning, have the potential to improve turn compliance, reduce caregiver burden, and decrease PU incidence.⁷

Objective

This study aimed to evaluate the effectiveness of current prevention and treatment interventions for pressure ulcers, with a particular focus on emerging technologies, support surfaces, nutritional strategies, and caregiver education. Additionally, this study examines the disproportionate impact of pressure injuries on high-risk and underserved populations, emphasizing the clinical, psychosocial, and systemic implications of pressure ulcer management across diverse care settings.

Methods

A systematic literature review and meta-analysis were conducted using PubMed, Google Scholar, and ScienceDirect, focusing on studies published between 2014 and 2025. Studies were selected based on their relevance to the incidence, pathophysiology, microbiological risk, and prevention of pressure ulcers, particularly in high-risk populations. The included studies evaluated innovations such as wearable sensors, prophylactic dressings, specialized mattresses, and microbiome profiling. Additional emphasis was placed on literature from low-resource settings to assess disparities in prevention practices and healthcare infrastructure (**Figure 1**).

Methods

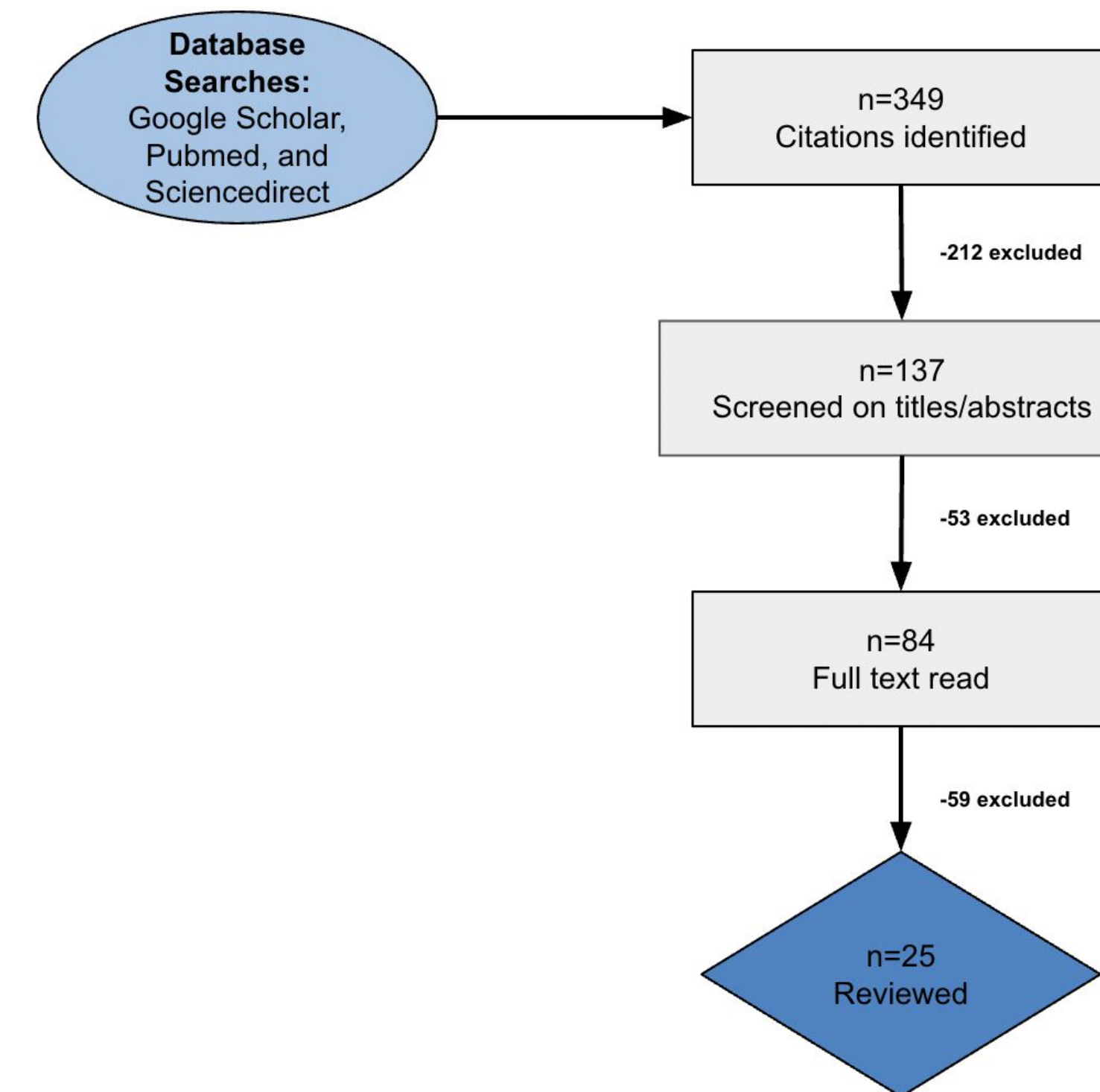


Figure 1: Overview of Data Collection Methods. Adapted from: Covidence Systematic Review Software⁸

Results

A total of 25 peer-reviewed studies met the inclusion criteria for this review.

- **Prevention strategies analyzed across studies**
 - Support surfaces, such as alternating pressure mattresses, high-specification foam mattresses, and multi-layered polyurethane dressings, to redistribute pressure.^{4,5,6}
 - Positioning interventions, including sensor-based and non-contact monitoring systems, to improve repositioning frequency and compliance.⁷
 - Nutritional supplementation, including protein, amino acids, and collagen, to improve skin integrity and wound healing.⁹
 - Caregiver education programs to enhance awareness and implementation of PU prevention practices at home and in clinical settings.¹⁰
- **Treatment interventions examined**
 - Advanced wound dressings, such as foam, hydrocolloid, and gelatin-based dressings, to maintain a moist healing environment and reduce the risk of infection.¹¹
 - Negative pressure wound therapy (NPWT) to promote granulation tissue formation and accelerate wound closure.¹²

Results (continued)

Table 1: Summary of Clinical Interventions for Pressure Ulcer Prevention and Treatment.^{10,12,13,14,15,16,17,18}

Study	Intervention Type	Outcome
Van Helden et al., 2024	Sensor-based position monitoring	Inertial sensors ↑ turn compliance, potential ↓ PU risk; other sensors showed variability
Langer et al., 2024	Nutritional interventions and supplements	Low to very low certainty evidence that supplements may have little to no effect on PU prevention; some supplements may slightly improve healing; moderate certainty only for collagen improving the ulcer area
Forni et al., 2022	Multi-layer polyurethane foam	72.2% PU reduction (medical), 61.4% reduction (surgical), no significant effect in ICU (p = 0.141)
Hahnel et al., 2022	Sacral & heel foam dressings + standard care	PU incidence: 2.8% (intervention) vs. 10.5% (control); RR 0.26; Absolute risk ↓ 8% (p = 0.001)
Nixon et al., 2019	Alternating Pressure Mattress vs. High Specification Foam Mattress comparison	No significant difference overall; APM reduced new PU category ≥2 during treatment phase by 2.6% (p = 0.0176)
Minteer et al., 2019	Non-contact repositioning monitoring	Pressure ulcer monitoring platform devices detected 137 repositioning events with 85% reliability; minimal false positives; potential to improve PU prevention with future SMS alert integration
Kaur et al., 2018	Informal caregiver training (2 strategies)	Better PU prevention with training + counseling; 87% mobility improvement vs. 75% in control
Li et al., 2016	Gelatin sponge + moist wound-healing	92.0% improvement rate vs. 68.0% control; ↓ Braden score & PU area; ↓ dressing changes & hospitalization cost
Srivastava et al., 2014	Negative pressure wound therapy (NPWT) device	NPWT group showed ↑ healing rates, ↑ granulation, ↓ wound size and depth vs. conventional methods; device was safe, low-cost, and effective

Across studies, interventions that incorporated multidisciplinary protocols, early mobilization, and customized care plans demonstrated the most significant reductions in PU incidence and severity. High-risk anatomical locations (especially sacral, ischiatic, and trochanteric areas) remained the most commonly affected, with immobility, advanced age, poor nutrition, and chronic comorbidities consistently reported as key risk factors.^{3,9,19}

Discussion

Health Disparities in Chronic Wound Care

The occurrence of pressure ulcers in underserved and medically complex populations reflects more profound disparities in healthcare access and quality. Limited mobility, communication challenges, and inconsistent follow-up care disproportionately affect individuals with disabilities, the elderly, and those in under-resourced settings.^{20,21}

Impact on Quality of Life and Caregiver Burden

Pressure ulcers significantly impair quality of life, leading to chronic pain, restricted mobility, and increased dependence on caregivers. For individuals with cognitive or physical impairments, these wounds not only cause physical distress but also contribute to emotional and psychological suffering.²⁰

Prevention and Early Intervention Strategies

Evidence consistently supports the effectiveness of routine skin assessments, repositioning schedules, nutritional support, and pressure-relieving devices in preventing pressure ulcers.³

Technology and Innovation in Wound Monitoring

Emerging technologies have shown promise in advancing the prevention and management of PUs. Sensor-based systems that monitor patient positioning and movement have been shown to enhance adherence to repositioning protocols. Non-contact monitoring platforms and integrated alert systems offer additional avenues for timely intervention.^{6,13}

Conclusion

- This systematic review underscores the heightened risk and prevalence of pressure ulcers among cognitively impaired and medically complex individuals driven by clinical vulnerability and systemic gaps in preventive care.
- The most substantial evidence was found linking immobility, incontinence, and impaired sensory perception to pressure ulcer development, with delays in diagnosis and inconsistent preventive strategies compounding the risk.⁴
- Further research is needed to evaluate the long-term effectiveness of targeted prevention protocols, caregiver support interventions, and innovations in wound monitoring technologies.

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