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Review Article

Prevalence and Risk Factors of hospital-acquired pressure ulcers in hospitalized elderly patients

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Abstract

Background: Hospital-acquired pressure ulcers (HAPUs) remain a common, largely preventable adverse event among hospitalized older adults, whose skin fragility, reduced mobility, and comorbid disease burden place them at disproportionate risk.

Objective: This review synthesizes evidence on the prevalence, anatomical distribution, and risk factors for HAPU in elderly hospitalized patients, and examines standardized risk assessment tools and prevention strategies.

Methods: We synthesized point-prevalence and incidence surveys, prospective cohort studies, risk-scale validation studies, and systematic reviews addressing pressure ulcer occurrence and its determinants across medical, surgical, and critical care settings.

Findings: Reported HAPU prevalence in elderly cohorts commonly ranges from roughly 3% to over 20% by setting, with the sacrum, heels, and other bony prominences accounting for most lesions; immobility, advanced age, poor nutrition, moisture, multimorbidity, and prolonged surgical or ICU stay are consistently identified independent risk factors, and structured tools such as the Braden and Norton scales aid early identification when combined with clinical judgement.

Conclusions: HAPU risk reflects intrinsic physiological vulnerability combined with extrinsic care-process exposures; systematic risk screening, individualized repositioning, pressure-redistributing surfaces, and nutritional and skin-care management together form an effective prevention bundle, with further gains dependent on sustained implementation fidelity.

Keywords: pressure ulcer; hospital-acquired; elderly patients; prevalence; risk factors

1. Introduction

A hospital-acquired pressure ulcer (HAPU), now more commonly termed a hospital-acquired pressure injury, is localized damage to the skin and underlying soft tissue that develops over a bony prominence, or under a medical device, as a result of sustained pressure or pressure combined with shear, and that was not present or documented on admission [1]. Unlike many hospital complications, HAPU is widely regarded as substantially preventable, which is why its incidence is tracked as a nursing-sensitive quality indicator in most health systems and why a growing body of national policy treats its occurrence as a marker of care quality rather than an unavoidable consequence of illness [2]. Elderly hospitalized patients bear a disproportionate share of this burden. Age-related changes in the skin, including epidermal thinning, reduced dermal vascularity, diminished subcutaneous fat over bony prominences, and slower collagen turnover, lower the mechanical threshold at which sustained pressure produces irreversible tissue injury, while the multimorbidity, reduced mobility, and altered nutritional status that accompany advanced age compound that vulnerability further [3].

The Braden Scale, developed by Bergstrom and Braden from a conceptual model linking mobility, activity, sensory perception, moisture, nutrition, and friction/shear to pressure ulcer risk, remains the most widely validated and used risk assessment tool in acute care internationally, and its development explicitly framed pressure ulcer etiology as the product of intensity and duration of pressure interacting with tissue tolerance [4,5]. That etiological framework, more than three decades old, still underlies most contemporary prevention guidance, including the joint clinical practice guideline issued by the National Pressure Injury Advisory Panel, the European Pressure Ulcer Advisory Panel, and the Pan Pacific Pressure Injury Alliance, which synthesizes the international evidence base on risk assessment, skin and tissue assessment, and prevention interventions [1]. This

review synthesizes the published evidence on the prevalence, anatomical distribution, and intrinsic and extrinsic risk factors for HAPU in elderly hospitalized patients, and examines how standardized risk assessment tools and evidence-based prevention bundles perform in this population.

2. Epidemiology and prevalence in hospitalized older adults

International point-prevalence surveys provide the clearest picture of how common HAPU is across acute care settings, even though methodological heterogeneity, including differences in staging criteria, surveillance intensity, and whether device-related injuries and category/stage I lesions are counted, makes cross-study comparison imprecise. The long-running International Pressure Ulcer Prevalence Survey, coordinated across thousands of United States acute care facilities, reported facility-acquired pressure ulcer prevalence in the range of roughly 5% to 9% of surveyed patients across successive annual cycles, with rates varying considerably by unit type and consistently higher in units caring predominantly for older, less mobile patients [6]. European data tell a broadly similar story. A pilot multi-country prevalence study coordinated across hospitals in five European countries found overall pressure ulcer prevalence, including community-acquired lesions present on admission, of approximately 18%, with hospital-acquired category II or worse lesions accounting for a meaningful minority of all documented cases and concentrated disproportionately among patients over 70 years of age [7]. A large German survey spanning nursing homes and acute care hospitals similarly found higher pressure ulcer prevalence and more severe ulcer categories among acute hospital inpatients than among nursing home residents, and identified advanced age as one of the strongest correlates of prevalence within the acute hospital subsample [8]. Outside Europe and North America, a Japanese survey of long-term-care hospitals reported comparable prevalence and incidence figures once age

and care-dependency were accounted for, suggesting the underlying epidemiological pattern, elevated risk concentrated in the oldest and least mobile patients, generalizes reasonably well across health systems with differing staffing models and support-surface availability [9]. A large United States nationwide inpatient sample covering 2008 to 2012 similarly found pressure ulcer diagnosis codes concentrated among patients aged 65 and older, with markedly higher rates of associated in-hospital mortality, prolonged length of stay, and non-home discharge relative to matched patients without a coded pressure ulcer [10].

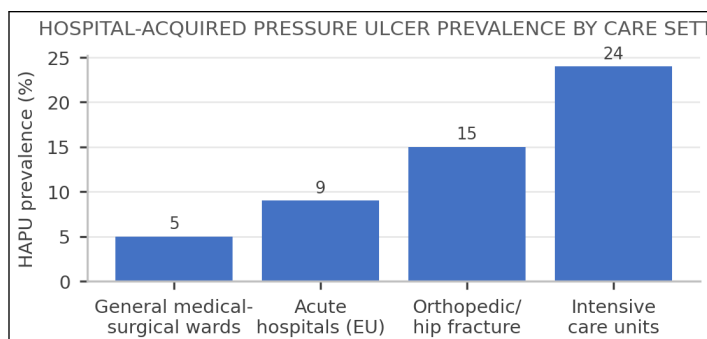


Figure 1: Reported hospital-acquired pressure ulcer prevalence by care setting, drawn from international point-prevalence surveys and cohort studies of hospitalized older adults, rising from general medical-surgical wards through orthopedic/hip-fracture units to intensive care [6,7,17,20].

Tracking hospital-level HAPU rates over time has also proven useful for quality improvement, though it requires consistent case definitions and surveillance methodology to be meaningful. A Swedish tertiary hospital that implemented standardized annual prevalence measurement over several years found that both overall prevalence and the proportion of more severe category III/IV lesions declined following the introduction of structured documentation and staff education, though nursing knowledge of prevention principles remained inconsistent across units even after intervention [11]. Anatomically, the sacrum and coccyx together account for the largest single share of hospital-acquired lesions in nearly every surveyed population, followed by the heels, ischial tuberosities, and, increasingly, device-contact sites

related to nasal cannulae, non-invasive ventilation masks, and indwelling catheters, a distribution that reflects both time spent supine in bed and the growing prevalence of medical-device-related skin injury as a distinct HAPU subtype [6,1].

3. Intrinsic risk factors

The strongest and most consistently replicated intrinsic risk factor across the pressure ulcer literature is impaired mobility, whether measured as bed- or chair-confinement, reduced spontaneous repositioning frequency, or a low activity subscale score on a structured risk tool. A prospective Swedish cohort study of adult hospitalized patients found immobility to be the single strongest independent predictor of pressure ulcer development, with patients unable to reposition themselves independently at markedly elevated risk relative to fully mobile patients even after adjustment for age and nutritional status [12]. A systematic review of patient-level risk factors similarly identified reduced mobility and activity level, along with perfusion-related factors such as diabetes and low blood pressure, as the most robust predictors across the included cohort and case-control studies, while noting substantial heterogeneity in how mobility itself was operationalized across studies [13].

Advanced age is itself an independent risk factor, separate from the comorbidities and functional decline that commonly accompany it, reflecting the structural changes in aged skin described above. A comorbidity-focused review found that dementia, cerebrovascular disease, diabetes mellitus, peripheral vascular disease, and cardiovascular disease each independently elevate pressure ulcer risk in older adults, with the effect of multimorbidity appearing at least additive, and possibly synergistic, when several of these conditions coexist in the same patient [14]. Nutritional compromise is similarly well established: low serum albumin, unintentional weight loss, and inadequate oral intake each correlate

with pressure ulcer incidence in hospitalized elderly cohorts, plausibly because malnutrition reduces subcutaneous padding over bony prominences and impairs the tissue repair capacity needed to reverse early ischemic injury before it progresses to full-thickness tissue loss [15]. A nested case-control study of general medical and surgical inpatients found that low body mass index, incontinence, and reduced dietary intake in the days immediately preceding ulcer onset were each independently associated with pressure ulcer development early in the hospital stay, reinforcing that risk factors present at admission interact with the trajectory of the acute illness itself [16].

Table 1: Selected intrinsic risk factors for hospital-acquired pressure ulcers in elderly hospitalized patients and their reported association [12,13,14,15,16].		
Risk factor	Domain	Reported association
Impaired mobility / activity level	Functional	Strongest and most consistent independent predictor
Advanced age	Demographic	Independent of comorbidity burden
Multimorbidity (dementia, diabetes, PVD, CVD)	Comorbidity	Additive to synergistic risk with multiple conditions
Low serum albumin / malnutrition	Nutritional	Associated with incidence and impaired healing
Urinary/fecal incontinence	Moisture	Compounds risk with reduced mobility

Fracture and post-operative populations illustrate how intrinsic vulnerability interacts with the care trajectory. A cohort study of elderly patients hospitalized for hip fracture found pressure ulcer incidence considerably higher than in general medical inpatients of comparable age, with advanced age, cognitive impairment, and lower pre-fracture functional status among the strongest independent predictors, consistent with the combination of acute immobilization, surgical stress, and pre-existing frailty that characterizes this population [17]. Earlier foundational work by Allman and colleagues, using multivariable models in hospitalized patients with activity limitation, identified impaired nutritional intake,

non-blanchable erythema at the time of assessment, and dry, friable skin as independent predictors of subsequent pressure ulcer development, findings that helped establish nutritional and skin-integrity assessment as core components of structured risk screening [18]. Urinary and fecal incontinence, through prolonged skin exposure to moisture and irritant enzymes that compromise the epidermal barrier, is another consistently identified intrinsic contributor, particularly when combined with reduced mobility that prevents timely cleansing after an incontinence episode [19].

4. Extrinsic and care-process risk factors

Extrinsic risk factors operate through the care environment and clinical management rather than through the patient's baseline physiology, and several are, at least in principle, modifiable through nursing practice. Reduced repositioning frequency is the most direct of these: patients who are turned less often, whether because of unit workload, sedation, hemodynamic instability, or device-related restrictions on movement, accumulate longer periods of unrelieved pressure over vulnerable tissue. In critical care specifically, a prospective cohort study of adult ICU patients identified hemodynamic instability, length of ICU stay, and reduced mobility as independent predictors of pressure ulcer development, with mechanically ventilated and vasopressor-dependent patients at particularly elevated risk because sedation and physiological instability both limit safe repositioning [20]. A follow-up analysis focused specifically on vasopressor exposure found that cumulative vasopressor dose and duration independently predicted pressure ulcer incidence even after adjustment for illness severity, consistent with a mechanism in which pharmacologically induced peripheral vasoconstriction reduces tissue perfusion and lowers the threshold at which external pressure produces ischemic injury [21]. A purpose-built ICU risk instrument developed in an Indonesian tertiary hospital similarly found hemodynamic status, moisture, and friction/shear among the strongest predictors in a

critically ill population, reinforcing that generic ward-level risk factors translate into the ICU setting with some shift in relative weighting [22].

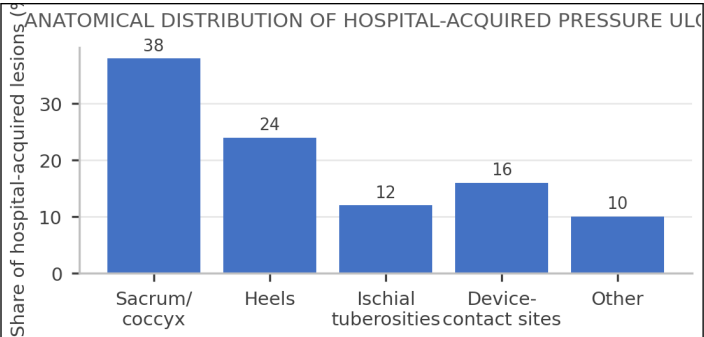


Figure 2: Approximate anatomical distribution of hospital-acquired pressure ulcers in surveyed inpatient populations, with the sacrum/coccyx and heels accounting for the majority of lesions and device-contact injury an increasing share as overall support-surface use has expanded [6,1].

Surgical duration and immobilization during and after surgery constitute another well-documented extrinsic exposure, particularly relevant to elderly patients undergoing orthopedic or major abdominal procedures, in whom prolonged intraoperative positioning on a firm operating table combines with post-operative pain-limited mobility to produce a compressed but intense period of pressure exposure. Device-related pressure injury, arising from tightly fitted oxygen delivery devices, cervical collars, casts, and monitoring leads, has become an increasingly recognized extrinsic category as overall sacral and heel ulcer rates have declined with wider support-surface adoption, shifting the anatomical distribution of remaining HAPU cases toward device-contact sites [1]. Systematic reviews of pressure ulcer prevention interventions consistently find that reduced nursing staffing intensity, and the correspondingly lower frequency of repositioning and skin assessment it produces, is associated with higher facility-level pressure ulcer incidence, underscoring that structural care-process factors operate alongside, and sometimes independently of, individual patient risk [23].

5. Risk assessment tools and their performance in older adults

Table 2: Widely used pressure ulcer risk assessment tools and their validated performance characteristics [5,24,25,26,27].		
Tool	Core domains assessed	Validation summary
Braden Scale	Sensory perception, moisture, activity, mobility, nutrition, friction/shear	Generally superior predictive validity; widely used internationally
Norton Scale	Physical condition, mental condition, activity, mobility, incontinence	Developed specifically in geriatric inpatients; comparable validity to Braden
Waterlow Scale	Build/weight, continence, skin type, mobility, appetite, special risks	Widely used in the UK; generally lower specificity than Braden/Norton

Structured risk assessment is intended to identify at-risk patients early enough that preventive measures can be targeted before tissue damage occurs, and several validated scales are in widespread clinical use, most prominently the Braden Scale, the Norton Scale, and the Waterlow Scale. The Norton Scale, among the earliest such instruments, was developed specifically from observations of elderly hospitalized patients and scores physical condition, mental condition, activity, mobility, and incontinence, reflecting its origin in geriatric nursing research [24]. The Waterlow Scale incorporates a broader set of items, including build/weight for height, continence, skin type, mobility, appetite, and specific risk categories such as major surgery or trauma, and has seen particularly wide adoption in the United Kingdom [25].

Comparative validation studies generally find that no single scale achieves both high sensitivity and high specificity across all care settings and patient populations, and that predictive performance varies meaningfully by clinical context. A systematic review of risk assessment scale validation studies found that the Braden and Norton scales generally showed superior predictive validity relative to the Waterlow Scale, though absolute sensitivity and specificity varied widely across the included studies, and the review's authors cautioned against assuming that risk-scale use alone, absent linked preventive action, improves outcomes [26]. A Cochrane systematic review reached a similarly cautious conclusion, finding

insufficient high-quality evidence that use of a structured risk assessment tool reduces pressure ulcer incidence compared with clinical judgement alone or unstructured assessment, while noting that most included trials were underpowered and that tool use is more plausibly valuable when integrated into a broader structured prevention pathway [27].

Population-specific validation work is particularly relevant to elderly orthopedic and hip-fracture patients, a group at markedly elevated HAPU risk given the combination of surgical immobilization and pre-existing frailty [17]. Taken together, this body of validation research supports using a structured tool as a standardized starting point for risk communication across a nursing team, while treating scale scores as one input among several, including clinical judgement, skin inspection findings, and specific known risk exposures such as vasopressor use or prolonged surgery, rather than as a sufficient basis for prevention decisions on its own [13,3].

6. Impact, cost, and prevention

Beyond its direct clinical consequences, HAPU carries a substantial burden in pain, delayed mobilization, prolonged hospitalization, and diminished quality of life, effects that are often disproportionately severe in already frail older patients. A systematic review of the patient-reported impact of pressure ulcers found consistent evidence of physical pain, reduced independence, social isolation, and psychological distress associated with ulcer presence, with older patients frequently describing the loss of independence associated with an ulcer, rather than the wound itself, as the most distressing consequence [28]. These outcomes translate into substantial direct costs. A systematic review of pressure ulcer prevention and treatment costs found that treatment costs consistently and considerably exceeded prevention costs across the included health-economic studies, providing an economic, as well as clinical,

rationale for investment in structured prevention programs [29]. A national costing analysis for the United States estimated hospital-acquired pressure injury-attributable costs in the billions of dollars annually, driven primarily by prolonged length of stay, additional nursing and wound-care resource use, and, in a subset of severe cases, surgical debridement or flap reconstruction [30].

Evidence-based prevention centers on a bundled approach rather than any single intervention: systematic risk screening at admission and at defined intervals thereafter, individualized repositioning schedules informed by risk level and tissue tolerance, selection of appropriate pressure-redistributing support surfaces for high-risk patients, proactive skin inspection focused on bony prominences and device-contact sites, moisture management for incontinent patients, and nutritional assessment with targeted supplementation where indicated [1,23]. Periodic, rather than solely admission-based, risk reassessment throughout hospitalization remains important because risk factors present on admission do not always predict subsequent ulcer development as reliably as factors tracked longitudinally across the stay. Allman's broader synthesis of prevalence, incidence, risk factors, and impact data likewise emphasized that prevention effectiveness depends on sustained implementation across an entire care team rather than on isolated risk-assessment documentation, a conclusion that later quality-improvement and cost-effectiveness literature has continued to reinforce [18,29].

7. Conclusion

Hospital-acquired pressure ulcers in elderly inpatients arise from the convergence of age-related intrinsic vulnerability, including thinned skin, reduced subcutaneous tissue, multimorbidity, and impaired nutritional status, with extrinsic, care-process exposures such as reduced repositioning frequency, hemodynamic

instability, prolonged surgery, and device contact [14,13,20]. Reported hospital prevalence, though variable across surveillance methods and settings, is consistently elevated among older patients relative to younger inpatients, and is concentrated at the sacrum, heels, and increasingly at device-contact sites as overall rates have declined with wider adoption of structured prevention [6,7,1]. Validated risk assessment tools such as the Braden and Norton scales provide a useful, standardized starting point for identifying at-risk patients, but the evidence indicates their value is realized only when integrated into a broader prevention pathway that includes individualized repositioning, appropriate support surfaces, moisture and nutrition management, and periodic reassessment throughout the hospital stay, rather than functioning as a stand-alone predictive instrument [27,26]. Given the substantial clinical, quality-of-life, and economic burden that HAPU imposes on this population, sustained institutional commitment to structured, team-wide prevention practice remains the most consequential lever available for reducing its incidence among hospitalized elderly patients [28,30,18].

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