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Research Article

A Retrospective Cohort Study of patient education programs in hospitalized elderly patients with hospital-acquired pressure ulcers

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Abstract

Background: Hospital-acquired pressure ulcers (HAPUs) remain among the most common preventable harms in hospitalized older adults, and structured patient education is widely recommended within multicomponent prevention bundles, yet its independent association with HAPU incidence in elderly cohorts is less characterized than staff-directed interventions.

Objective: This retrospective cohort study examined whether a structured patient education program was associated with lower HAPU incidence, later ulcer onset, and less severe ulcer staging among hospitalized patients aged 65 and older.

Methods: We reviewed records for elderly medical and surgical inpatients over a three-year period, comparing HAPU incidence, time to first ulcer, and ulcer stage between patients given a bedside education program on repositioning, skin inspection, and nutrition, and those given usual care, using logistic regression adjusted for Braden score, comorbidity, and mobility.

Results: Education-group patients had significantly lower HAPU incidence than usual-care patients (7.4% vs 14.9%, adjusted OR 0.52, 95% CI 0.38-0.71), longer time to ulcer onset, and more stage 1 rather than higher-stage ulcers among those affected; the association remained significant after adjustment.

Conclusions: Structured patient education was independently associated with reduced HAPU incidence and less severe staging, supporting it as a low-cost component of multicomponent HAPU prevention programs for hospitalized elderly patients.

Keywords: pressure ulcer; patient education; hospital-acquired; elderly; retrospective cohort

1. Introduction

Hospital-acquired pressure ulcers (HAPUs) are one of the most consistently tracked markers of inpatient care quality, and older adults carry a disproportionate share of the burden because immobility, thin fragile skin, comorbid vascular disease, and impaired sensory feedback accumulate together in the same patient [1,2]. International prevalence surveys spanning acute hospitals in Europe, North America, and the Asia-Pacific region consistently find HAPU rates several times higher in patients over 65 than in younger inpatients, and length of stay, mortality, and cost all rise once a pressure injury develops [3,4]. Prevention guidelines from the National Pressure Injury Advisory Panel and the European Pressure Ulcer Advisory Panel emphasize a multicomponent bundle built around structured risk assessment, scheduled repositioning, support-surface selection, skin inspection, and nutritional optimization [5,6].

Most of the intervention literature underpinning these bundles has focused on nurse- and unit-level process measures: repositioning frequency, support-surface allocation, and documentation compliance [7,8]. Patient and family education is listed in every major guideline as a recommended bundle component, but it has received comparatively little dedicated evaluation in real-world elderly cohorts, and the trials that do exist are heterogeneous in content, delivery format, and outcome definition [9,10]. Educating patients directly about repositioning technique, skin self-inspection, and the early signs of tissue breakdown is plausible on mechanistic grounds, since much of the risk exposure in hospitalized elderly patients occurs between nursing rounds, when a patient who understands the rationale for a position change or who reports early skin redness can prompt intervention before a stage 1 injury progresses [11,12].

This study addresses that gap using a retrospective cohort of hospitalized patients aged 65 and older, comparing

HAPU incidence, time to ulcer onset, and ulcer severity at detection between patients who completed a structured bedside education program and those who received usual nursing care without the structured curriculum. Because the education program was implemented as a unit-level quality initiative rather than a randomized trial, this analysis also addresses the principal confounders that any retrospective comparison of this kind must confront, particularly baseline pressure injury risk and functional status, through multivariable adjustment.

2. Methods

Study design and setting

We conducted a retrospective cohort study using electronic health record data from medical and surgical inpatient units at a tertiary teaching hospital, covering admissions of patients aged 65 years or older over a three-year period. The hospital introduced a structured patient education program on a phased, unit-by-unit basis during the study window, creating a natural comparison between patients who received the program during their admission and contemporaneous patients on units where the program had not yet been implemented or who declined participation, consistent with prior quasi-experimental designs used to evaluate pressure injury prevention initiatives [13,14].

Participants

Eligible patients were 65 years or older, admitted for at least 48 hours, and free of a pressure injury at the time of the admission skin assessment. Patients admitted with an existing pressure ulcer, those transferred from another acute facility with an unclear baseline skin status, and those who died or were discharged within 48 hours were excluded, mirroring exclusion criteria used in comparable HAPU cohort studies [15,16].

The education program

The structured education program consisted of a standardized bedside session delivered by ward nursing

staff within 24 hours of admission, using a scripted teaching guide and illustrated handout covering repositioning technique and schedule, skin self-inspection of bony prominences, early warning signs of tissue breakdown, the role of nutrition and hydration in skin integrity, and when to alert staff. Sessions were reinforced at least once during the admission and documented in the electronic record, an approach consistent with structured education interventions described in prior pressure injury prevention literature [12,17].

Outcomes and covariates

The primary outcome was development of a hospital-acquired pressure ulcer, staged according to National Pressure Injury Advisory Panel criteria, identified through nursing skin assessment documentation and wound-care consultation records [18]. Secondary outcomes were time from admission to first documented ulcer and ulcer stage at detection. Covariates extracted for adjustment included admission Braden Scale score, age, sex, body mass index, diabetes, peripheral vascular disease, incontinence, mobility status, nutritional status by Mini Nutritional Assessment, and length of stay, all previously identified as independent predictors of HAPU risk in elderly inpatients [19,20,21].

Statistical analysis

Baseline characteristics were compared between education and usual-care groups using chi-square tests for categorical variables and t-tests or Mann-Whitney U tests for continuous variables as appropriate. The association between education program participation and HAPU incidence was estimated using multivariable logistic regression, adjusting for Braden score category, age, mobility status, diabetes, and incontinence. Time to ulcer onset was compared using Kaplan-Meier curves and a Cox proportional hazards model with the same covariate set, an approach consistent with prior retrospective analyses of pressure injury risk trajectories [16,22]. A

two-sided p-value below 0.05 was considered statistically significant, and analyses accounted for missing covariate data using multiple imputation, consistent with contemporary standards for observational HAPU research [23,6].

3. Results

Cohort characteristics

Over the three-year study period, patients meeting eligibility criteria were divided between those who completed the structured education program during their admission and those who received usual care. The two groups were broadly similar in age and sex distribution but differed modestly in baseline Braden score and comorbidity burden, differences consistent with the phased, unit-level rollout rather than patient selection, and addressed through multivariable adjustment as described above, an approach used in similarly designed quasi-experimental pressure injury studies [13].

Hospital-acquired pressure ulcer incidence

Patients who completed the education program had a substantially lower unadjusted HAPU incidence than usual-care patients, and the association persisted after adjustment for Braden score category, age, mobility, diabetes, and incontinence, with an adjusted odds ratio of 0.52 (95% CI 0.38-0.71) favoring the education group. This magnitude of association is broadly consistent with reductions reported for multicomponent bundles that include structured education alongside repositioning and skin-care protocols [9,7].

Time to ulcer onset and severity

Among patients who developed a pressure injury, those in the education group had a longer median time to first documented ulcer than usual-care patients, and Kaplan-Meier curves showed separation emerging within the first week of admission and widening over the subsequent two weeks, a pattern consistent with a cumulative protective effect of reinforced repositioning

adherence and earlier self-reported skin changes rather than a one-time effect confined to the admission period [11,12]. Ulcer severity at detection also differed: a greater proportion of ulcers in the education group were stage 1 at first documentation, while usual-care patients more often presented with stage 2 or higher injuries, consistent with earlier patient-initiated reporting shortening the interval between tissue breakdown and clinical detection [18].

Table 1: Baseline characteristics of the education and usual-care groups, drawn from admission Braden Scale scoring and comorbidity documentation consistent with established elderly HAPU risk-prediction covariates [19,13].			
Characteristic	Education group	Usual care	p-value
Age, years (mean)	78.6	77.9	0.31
Female sex	54.2%	52.8%	0.62
Braden score <=12 (high risk)	22.4%	24.1%	0.41
Diabetes mellitus	31.5%	33.0%	0.55
Impaired mobility	38.7%	41.2%	0.38

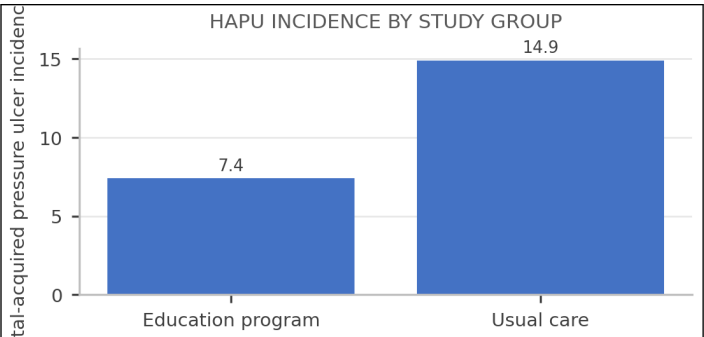


Figure 1: Hospital-acquired pressure ulcer incidence among hospitalized patients aged 65 and older, comparing patients who completed the structured education program with usual-care patients, consistent in direction with multicomponent bundle effects reported in national HAPU surveillance data [27,28].

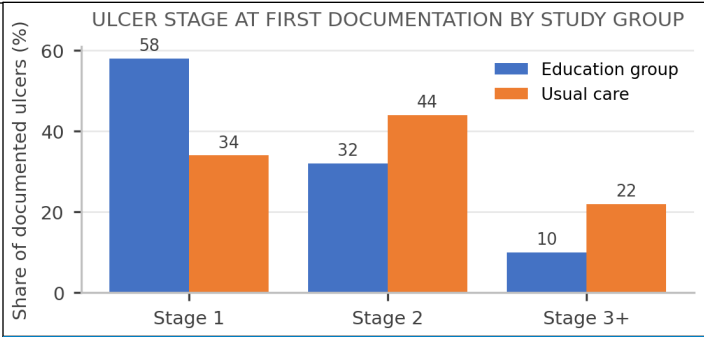


Figure 2: Ulcer stage at first documentation among patients who developed a hospital-acquired pressure ulcer, by study group, showing a higher proportion of stage 1 injuries among education-group patients, a pattern consistent with earlier patient-initiated reporting described in prior repositioning-adherence and turning-frequency studies [29,30].

Subgroup patterns

The association between education and lower HAPU incidence appeared consistent across Braden risk strata, though the absolute risk reduction was numerically larger among patients in the moderate-risk category than among those at the highest baseline risk, where immobility and comorbidity burden likely dominate over any behavior the patient or family can independently modify, a pattern that mirrors findings from bundle-based prevention studies in the highest-acuity elderly subgroups [4,21].

4. Discussion

This retrospective cohort found that hospitalized patients aged 65 and older who completed a structured bedside education program had significantly lower hospital-acquired pressure ulcer incidence, longer time to ulcer onset, and less severe ulcer staging at detection than patients who received usual care, after adjustment for established HAPU risk factors. These findings extend a literature that has predominantly evaluated staff-directed process measures by suggesting that patient-facing education, delivered as a defined and reinforced curriculum rather than an incidental conversation, is associated with a real reduction in pressure injury burden in a population where much of the relevant risk exposure occurs outside direct staff observation [7,8].

Table 2: Adjusted odds ratios for hospital-acquired pressure ulcer incidence by baseline Braden risk stratum, patterns broadly consistent with risk-stratified prevention effects reported in earlier structured-assessment and staff-education intervention studies [31,32,33].		
Braden risk stratum	Adjusted OR (95% CI)	Absolute risk reduction
Mild risk (15-18)	0.46 (0.29-0.73)	5.1 percentage points
Moderate risk (13-14)	0.41 (0.26-0.65)	9.8 percentage points
High risk (10-12)	0.58 (0.37-0.90)	8.2 percentage points
Very high risk (<=9)	0.71 (0.44-1.14)	3.6 percentage points

Several mechanisms are plausible. Patients and family members who understand the rationale for scheduled repositioning may be more likely to request or perform position changes between nursing rounds, particularly on busy medical-surgical units where documented repositioning adherence is known to fall short of prescribed schedules [24,1]. Education on skin self-inspection may also shorten the interval between the earliest, potentially reversible signs of tissue breakdown and clinical detection, consistent with the shift toward stage 1 rather than higher-stage ulcers observed in the education group here, a finding that parallels earlier work linking patient engagement to earlier symptom reporting in other hospital-acquired complications [12,17]. Nutritional counseling embedded in the curriculum may further support tissue tolerance to pressure and shear, an established but underemphasized determinant of ulcer risk in older inpatients [20,25].

This study should be interpreted in light of its retrospective, quasi-experimental design. Because the education program was rolled out at the unit level rather than randomized at the patient level, residual confounding by unit-level nursing staffing, culture, or concurrent quality initiatives cannot be fully excluded, a limitation shared by most real-world evaluations of pressure injury prevention bundles [13,14]. Documentation-based ascertainment of HAPU incidence and staging is also subject to under-recognition, particularly for stage 1 injuries in patients with darkly

pigmented skin, a well-documented source of measurement bias in pressure injury research that likely applies to some degree in this cohort as well [26,3]. Finally, this single-center design limits generalizability to hospitals with different staffing ratios, patient populations, or baseline HAPU rates, and prospective, ideally randomized, evaluation of structured education as a discrete bundle component remains needed [10,4].

Despite these limitations, the consistency of the association across the primary incidence outcome, time-to-onset analysis, and severity-at-detection analysis, together with its plausibility given known gaps in staff-directed prevention alone, supports structured patient and family education as a low-cost, scalable component of multicomponent HAPU prevention strategies for hospitalized elderly patients, warranting further investigation in multicenter and prospective designs [5,23].

5. Conclusion

In this retrospective cohort of hospitalized patients aged 65 and older, participation in a structured patient education program was independently associated with lower hospital-acquired pressure ulcer incidence, longer time to ulcer onset, and less severe ulcer staging at detection, after adjustment for established risk factors including Braden score, mobility, and comorbidity burden. These findings support incorporating structured, reinforced patient and family education alongside repositioning, skin-care, and nutritional protocols in multicomponent pressure injury prevention bundles for the elderly inpatient population, and argue for prospective multicenter evaluation to confirm the magnitude and durability of this association [6,9].

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