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Predicting Pressure Injury Prevention Education by Acute Care Nurses Within 24 h of Hospital Admission: A Cross-Sectional Study

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ABSTRACT

Aim: Predicting medical/surgical nurses' delivery of patient pressure injury prevention education within 24 h of hospitalisation.

Design: A cross-sectional sub-study drawn from a larger multisite randomised controlled trial.

Methods: A consecutive sub-sample of 300 randomly assigned control group participants was recruited from 20 medical and surgical wards at two major hospitals (July 2020 to August 2023) in Queensland, Australia. Semi-structured observations and chart audit data were collected, including patient education, demographic and clinical data. Binary logistic regression identified hospital site, clinical and patient predictors contributing to pressure injury prevention education delivery by nurses.

Results: Seventeen (5.7%) participants received pressure injury prevention education within the first 24 h of admission. Body mass index was an independent predictor, increasing the odds of nurses delivering patient education.

Conclusion: Few episodes of pressure injury prevention education were observed in this study. As a patient's body mass index rises, they are more likely to receive preventative education from nurses soon after admission.

Implications for Practice and Policy: Our findings underscore the need for standardised inclusive protocols and ongoing nurse training to assess and address education needs beyond single risk factors like body mass index. Further research should explore other factors influencing patient education delivery in hospitals.

Reporting Method: This study adhered to STROBE guidelines. Dr. Brett Dyer, statistician, is part of the author team.

Patient or Public Contribution: No patient or public contribution.

1 | Introduction

Pressure injuries (PI), also known as pressure ulcers (PU), decubitus ulcers or bed sores, affect over 3 million patients across all healthcare settings worldwide (Yakupu et al. 2022), including 1.89 million 'hospitalised' patients each year (Li et al. 2020; Padula and Delarmente 2019; Rodgers et al. 2021). PI are caused by prolonged pressure or pressure in combination with shear, resulting in localised skin and/or underlying tissue damage over bony prominences or related to medical

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Summary

- What is already known
  - Low patient education on pressure injury prevention may decrease patients' participation in preventative behaviours and impact outcomes.
- What this paper adds
  - Our research highlights the under-delivery of patient pressure injury prevention education by nurses in acute care. A positive correlation was found between increasing body mass index and pressure injury education reflecting risk-based care; however, it raises concern regarding equitable education for all 'at-risk' patients.

or other devices (National Pressure Injury Advisory Panel (NPIAP), European Pressure Ulcer Advisory Panel (EPUAP) and Pan Pacific Pressure Injury Alliance (PPPIA) 2025). PI range from Stage 1 (non-blanchable erythema) to Stage 4 (full-thickness tissue loss exposing muscle, tendon, or bone) as well as unstageable, where the depth is unknown or suspected deep tissue injury with maroon or discoloured purple skin is localised (NPIAP, EPUAP and PPPIA 2019). When PI develop during hospitalisation, they are referred to as a hospital-acquired pressure injury (HAPI) with prevalence rates across all hospital settings close to 13% (Rodgers et al. 2021), while in acute medical/surgical settings PI affects 6% to 18.5% of patients (Tubaishat et al. 2018). Stages I and II are the most common PI, with the sacral/coccyx region (41%) the most prevalent anatomical location (Rodgers et al. 2021; NPIAP, EPUAP and PPPIA 2019). Patient-related risk factors such as poor nutrition, incontinence, hospitalisation, recent surgery, certain medical conditions and a history of prior pressure injuries predispose patients to PI development (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). Further, a patient's own tissue tolerance (age, health status and microclimate) (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019; Gefen et al. 2022), tissue perfusion e.g., diabetes (Coleman et al. 2013), and mobility levels are independent predictors of PI development (Coleman et al. 2013).

Concerningly, PI resulted in close to 25,000 deaths in 2019 (Yakupu et al. 2022), with an estimated treatment cost ranging from over 5 billion pounds in the United Kingdom to approximately $27 billion USD in the United States (Padula and Delarmente 2019; Guest et al. 2015). In a global burden of disease study conducted between 1990 and 2017, PI incidence and morbidity rates remained consistent (Siotos et al. 2022), hence PI prevention (PIP) is a key initiative in healthcare institutions globally (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). The international clinical practice guidelines (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019) recommend involving patients in preventative education during hospital admission (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). Therefore, increasing patient knowledge of and participation in their own PIP behaviours during hospitalisation may reduce the economic burden on healthcare institutions associated with treatment costs (Li et al. 2020; Padula and Delarmente 2019; European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019).

2 | Background

On or soon after hospital admission, a full PI risk assessment for all patients is recommended (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). In addition to clinician judgement, nurses conduct a comprehensive skin assessment and PI risk assessment with patients using recommended tools such as Waterlow (Waterlow 1985), Norton (Norton et al. 1962) and Braden (Bergstrom et al. 1987) depending on the hospital policy and ward setting (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). These risk assessment tools consider a range of modifiable and non-modifiable risk factors such as age, gender, mobility/activity, continence and nutrition status, medications and comorbidities, to calculate a patients level of risk for PI development (Waterlow 1985; Norton et al. 1962; Bergstrom et al. 1987). The outcome of this assessment helps to inform the nurses when planning individualised patient PIP care such as regular repositioning and patient education (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). Specifically, engaging patients and caregivers in PIP education during their hospital admission is recommended by international clinical practice guidelines (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). Moreover, prevention care bundles such as the 'aSSKINg' framework include the 'giving of information' (Martin and Holloway 2024), as well informed patients are more likely to engage in their PU care (Young 2021). The benefits of delivering patient PIP education include improved patient knowledge (Thomas et al. 2022), greater satisfaction (Wan et al. 2023; Roberts et al. 2016), enhanced confidence (Latimer et al. 2014), and increased participation in their own preventative care (Young 2021; Thomas et al. 2022; Deakin et al. 2020). A study of 20 patients (Robineau et al. 2019), found demonstrated improvement in patients PIP behaviours and knowledge following participation in patient education programmes, amongst adult patients with a spinal cord injury (Deakin et al. 2020). This finding is consistent with earlier research (Deakin et al. 2020), where patients experienced higher levels of both knowledge of and participation in their own PIP care following receipt of education by nurses (Thomas et al. 2022; Deakin et al. 2020). Despite the benefits, only 1.4%–37% of patients receive PIP education from nurses during hospital admission (Deakin et al. 2020; Chaboyer et al. 2017; Li et al. 2021a, 2021b).

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PIP education delivery by nurses can include up to 14 subtopics to discuss with patients such as PI risk factors, aetiology, information access, diet, positioning, skin care, dressings and immobility (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). A patient's own PI risk level is less commonly addressed topics, while repositioning and skin hygiene are frequently discussed (Li et al. 2021b). Importantly, international clinical practice guidelines highlight that all patients should receive PIP education regardless of their own PI risk level (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). Whilst nurses conduct skin assessments in the first 8 h of a patient's admission, the ability for nurses to deliver education to patients in this early stage may be problematic. Whilst nurses aim to prioritise patient PIP education (Latimer et al. 2021; Tubaishat and Aljezawi 2013; Li et al. 2022), multiple barriers hinder delivery including competing administrative tasks on patients admission, heavy workload (Wan et al. 2023; Latimer et al. 2021), patient acuity (Latimer et al. 2021), lack of time, poor communication (Beal and Smith 2016) and nurses' knowledge gaps in risk assessment (Wan et al. 2023; Tubaishat and Aljezawi 2013). Improving access to up-to-date hospital policies and enhancing nurses' knowledge is necessary for effective PIP education delivery (Wan et al. 2023; Li et al. 2022). For example, a United States study of an acute care hospital over a 10-years period (Beal and Smith 2016) found that evidence-based nurse and patient PIP education programmes reduced HAPI prevalence rates from 7.8% to 1.4%. Similarly, a scoping review of over 240 clinicians across Ireland, Hong Kong and India, including settings such as aged care, found improved levels of patient knowledge in PIP, nutrition, and mobility; however, patients' knowledge retention and prolonged behaviour change remain unclear (Sahay et al. 2024). Moreover, nurses should consider patient-specific factors such as cognition, education level, physical ability, and clinical condition before education delivery (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). However, research supporting nurses in the process of education delivery is limited.

A Spanish survey of 458 hospital-based nurses revealed low rankings for both knowledge and teaching opportunities for PIP education (Pueyo-Garrigues et al. 2022). Interestingly, an Australian study of approximately 700 nurses (Barakat-Johnson et al. 2018) reported 80% ($n = 532$) possessed higher scores for knowledge (70% or more correct) and attitudes 44.43 ± 4.77, out of 55 (80.7%) toward PIP. Furthermore, increased years of experience was noted to positively correlate to higher PIP attitude scores. In contrast, a Chinese study (Jiang et al. 2020) found over 40% ($n = 754$) of over 1800 nurses had inadequate PIP knowledge, and 47% ($n = 842$) held negative attitudes toward PIP activities. Providing patient PIP education is a multifaceted process, with limited patient-centric teaching approaches (Dwamena et al. 2012) and poorly timed education delivery (Kang et al. 2020; Deakin et al. 2023) by clinicians challenging delivery. Whilst research on predictors of acute care nurses PIP education practices is limited and several factors are noted to influence PIP implementation, including education. For example, nurses focused on only three key prevention strategies: repositioning, monitoring skin changes, and pressure-relieving devices for patients with spinal cord injuries despite their 14-fold increased risk of PI due to prolonged immobility (Sprigle and Sonenblum 2011). Further, a 2017 observational study found that nurses were more likely to deliver preventative PIP education to patients with an 'at-risk' Waterlow score (10–14), over 400% more than patients with 'no-risk' (Latimer et al. 2017).

Whilst predictors for PI development are well documented, research on predictors influencing nurses' delivery of PIP education in acute care is limited—prompting this exploratory study to examine hospital site, clinical, and patient-related factors predicting its delivery.

3 | The Study

3.1 | Aim

The study aimed to determine the extent to which hospital site, clinical, and patient factors contribute to adult medical/surgical patients' receipt of PIP education by nurses within the first 24 h of hospitalisation. We hypothesised that hospital site, clinical (admission type – medical/surgical), and patient factors (age, sex, body mass index (BMI) score, Waterlow score, number of comorbidities, and number of high-risk medications) (steroids, anti-inflammatory, anti-coagulant) predicted nurses' delivery of PIP education to adult medical/surgical patients within 24 h of hospital admission at two Australian hospitals.

4 | Methods

4.1 | Design

This cross-sectional sub-study gathered semi-structured observations and chart audit data on demographic and clinical data including patient education from a larger Australian multisite, parallel group randomised control trial. The trial was registered with the Australian and New Zealand Clinical Trial Registry on 22 May 2019 (ACTRESN12619000763145) examining the effectiveness of prophylactic foam dressings in the prevention of sacral pressure injuries in at-risk hospitalised patients (Walker et al. 2023). Control group participants received standard care including patient education, whereas the intervention group received standard care including patient education plus the Mepilex intervention dressing. The results of the larger trial are not published at the time of report; hence, control group only participants are included in this study. The parent trial was conducted across three sites; however, the study sub-sample was only drawn from sites A and B due to the similarities between the two hospitals and medical/surgical ward processes, including the use of integrated electronic medical records which were unavailable at Site C. Moreover, the commencement of data collection was delayed in the parent trial (Walker et al. 2023) for this site, with data unavailable for this study.

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TABLE 1 | Inclusion and exclusion criteria.

Criteria	Patients
Inclusion criteria	• ≥18 years of age; written informed consent • Assessed as being at-risk of HAPI using Waterlow score • Recruited within 36 h of hospital admission • Expected hospital length of stay ≥24 h following recruitment • Assigned to the Control group • Participation recruited once to study • Independent and/or limited mobility (such as independent with walking aid, 1 or 2 assist)
Exclusion criteria	• Patients admitted to high-dependency, critical care (such as intensive care), maternity, mental health, and rehabilitation settings • Patient is unable to be turned (e.g., due to unstable spinal injury) • Patients who have an existing sacral PI, skin allergy or lesion (sacrum) at the time of recruitment • Patients with urinary and/or faecal incontinence at the time of recruitment • Patients unable to speak or understand English (if no interpreter present)

4.2 | Study Setting

The multisite study was conducted in 20 acute care medical and surgical wards at two tertiary teaching hospitals in South-East Queensland, Australia. Site A is an 866-bed hospital with nine acute care units recruited to the study (medical/surgical) (Queensland Government 2023a). Site B has 1052 beds with 11 acute care (medical/surgical) wards recruited to the study (Queensland Government 2023b). Both sites offer a range of acute medical and surgical services, with Site A reporting 161,109 acute inpatient admissions in 2022–2023 (Queensland Government 2023a), while Site B reported 123,259 patient admissions during the same period (Queensland Government 2023b). Both Queensland Health facilities have similar PIP practices, policies and protocols. Our study was conducted in acute care medical and surgical units, where most patients were admitted either via the post-anaesthetic care unit for surgical patients or through the emergency department (for medical or surgical cases).

4.3 | Sample/Participants

The study sample consisted of the first 150 participants (300 participants in total), who were randomly allocated to the control group at hospital Sites A and B from within the parent trial (Walker et al. 2023). An a priori power analysis was used to determine the required sample size (Soper 2024). To achieve the desired statistical power of 0.80 (significance level 0.05), assuming a medium effect size ($f^2 \geq 0.15$) with nine predictors in the regression model, a minimum sample size of 113 operative procedures was required (Soper 2024). A larger sample was recruited to enhance the robustness and stability of the analysis and resultant regression model (Polit and Beck 2011).

4.4 | Inclusion and Exclusion Criteria

The inclusion and exclusion criteria for the study participants are outlined in Table 1 and drawn from the larger parent trial (Walker et al. 2023).

From Monday to Friday the research nurses used the study criteria to screen all patients admitted to the recruited units within the previous 24 h of hospital admission. Eligible patients were approached by the nurse unit manager or delegate who obtained permission for the research nurse to approach them. For interested patients, the research nurse provided a study overview, responded to their questions, and obtained written consent from participants willing to be recruited. Prior to recruitment, the research nurse completed a Waterlow (Waterlow 1985) assessment to confirm their study eligibility. Written informed consent was obtained from willing patients or their family member, or legal guardian (proxy).

4.5 | Measures

This study is exploratory in nature with an absence of literature on the predictors of PIP education reported. Accordingly, we adopted a range of factors including hospital site, clinical and patient factors when conducting this exploratory analysis (Table 2). Registered nurses at both hospitals were responsible for PI risk assessment and determining the PIP education received by adult in-patients. To inform the selection of predictor variables for this exploratory analysis, the clinical experience of the nurses, prior research (Latimer et al. 2017), and several patient-related risk factors, such as BMI and Waterlow score (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019; Waterlow 1985) were included (Table 2). Table 2 details data collection methods for variables such as age, sex and BMI.

BMI is a numerical measure of body size and nutritional status (WorldHealthOrganisation 2010), increasing PI risk in both underweight and overweight individuals (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). The authors considered using BMI as a binary variable (low vs. high BMI). However, due to the exploratory nature of the study and the lack of guidance in the literature with which to numerically determine the cut-offs (low vs. high BMI), we have used BMI as a continuous

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TABLE 2 | Data collection methods, variables, and level of measurement.

Method of data collection	Variable	Predictive factor	Outcome or predictor variable	Level of measurement
Chart audit medical record	Age (years)	Patient	Predictor	Continuous
	Waterlow score	Patient	Predictor	Categorical
	At-risk (10–14)			
	High-risk (15–19)			
	Very high-risk (≥ 20+)			
	Body mass index (score)	Patient	Predictor	Continuous
	Sex (M/F)	Patient	Predictor	Continuous
	Number of comorbidities	Patient	Predictor	Categorical
	0–2			
	3+			
	Number of high-risk medications	Patient	Predictor	Categorical
	1			
	2+			
	Admission type (med/surg)	Patient	Predictor	Categorical
Semi-structured observations	Hospital site (A or B)	Clinical	Predictor	Categorical
	Pressure injury education received within 24 h of hospital admission self-reported (yes/no)	Clinical	Predictor	Categorical
			Outcome	Categorical

variable (Table 3) to meet the study aims. Comorbidity data, including chronic respiratory, neurological, and cardiovascular conditions, were recorded alongside high-risk medications (e.g., steroids, anti-inflammatories, anti-hypertensives, anticoagulants), which can compromise immune response, vasculature, and skin integrity, thus increasing PI susceptibility (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). 'Hospital admission' was defined as the first 24 h of hospitalisation, with recruitment occurring within this period to account for delays in unit admission. This timeframe allowed clinicians to complete PI risk assessments (e.g., Waterlow score) and implement prevention strategies, including PIP education. The research nurse verified Waterlow scores, and patients scoring > 10 were included. 'Admission type' was categorised as medical or surgical, and 'Hospital site' as either 'A' or 'B' per the parent trial. Given the study's exploratory nature, these predictor variables were selected.

4.6 | Data Collection

Data collection adhered to the STROBE statement for observational studies. Site-specific data collection occurred for Site A between July 2020 and November 2022; whilst Site B was between August 2020 and August 2023. Before data collection, all research nurses completed training in research ethics practices, Research Electronic Data Capture [REDCAP] (REDCap 2020), understanding the study protocol, participant screening and recruitment practices, and data collection methods to ensure the integrity of the data collection process by the authors. Recruitment and first 24-h admission data were collected by the research nurse via semi-structured observations and chart audit data, guided by the international CPGs for PIP (National Pressure Injury Advisory Panel (NPIAP), E.P.U.A.P.E.A.P.P. and P.I.A. (PPPIA) 2025) on demographic and clinical data including patient education. This information was entered directly into a secure web-based platform (REDCAP) (REDCap 2020) hosted by Griffith University. Patient education was recorded through patient self-report (structured), whilst documented evidence of PIP education delivery was obtained via the patient medical record. In the parent trial, observations included other factors such as completed Waterlow risk assessments, patient mobility status, nutritional status, and implemented PIP interventions such as support surfaces, heel pads and skin care (barrier creams) including daily skin assessment of the sacrum (blanchable). This data is not available for the sub-study with the results of the parent trial not published at the time of report. The site investigator and research nurses at each recruited hospital were responsible for participant recruitment Monday to Friday between 08:30 and 17:00 throughout the data collection period.

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TABLE 3 | Patient baseline demographics and clinical characteristics ($n = 300$).

Demographic and clinical characteristics	*n* (%)
Hospital site	
Site A	150 (50.0%)
Site B—no. (%)	150 (50.0%)
Admission type	
Surgical—no. (%)	194 (64.7%)
Sex	
Male—no. (%)	199 (66.3%)
Age (years)—mean (SD)	66 (26–89)
Body mass index score	
Mean (SD)	29.5 (6.2)
Number of high-risk medications	
1—no. (%)	243 (81.0%)
2+—no. (%)	57 (19.0%)
Number of comorbidities	
0–2—no. (%)	207 (69.0%)
3+—no. (%)	93 (31.0%)
Waterlow score	
At-risk (10–14)	153 (51.0%)
High-risk (15–19)	106 (35.3%)
Very high-risk (≥20+)	41 (13.7%)
PIP Education received in first 24 h of hospital admission	
Yes—no. (%)	17 (5.7%)

Abbreviations: IQR, interquartile range; M, Median; *n*; number; PIP, PI prevention.

Due to the study design and reduced number of research nurses at each study site, participants were recruited within the first 24 h of hospital admission.

On recruitment, participants' demographic and health data including sex, reason for admission, mobility status, BMI, the type of and number of comorbidities (such as cardiovascular disease, diabetes, cognitive impairment, and malnutrition on admission), current smoking status, Waterlow score, number of high-risk medications (as completed and documented by the ward nurse on admission), existing PI (other than sacral) and its treatment/management, previous history of PI were recorded. The description of each variable and the data collection methods are highlighted in Table 2. Patient self-reported data 'have you received PIP information since admission?' was the primary variable outcome. The outcome variable PI education received within 24 h of hospital admission were binary (yes = 1, no = 2). Eight candidate (potential) predictor variables were examined; five were categorical and three were continuous (Table 2). Data on hospital length of stay were later obtained post hospital discharge (Elo and Kyngas 2008).

4.7 | Ethical Considerations

Approvals from human research ethics committees were received from both hospital sites and universities (HREC/2019/QGC/51088 and Griffith University [2019/685–10 September 2019]). The statement for observational studies (STROBE) guided the study reporting (von Elm et al. 2008).

4.8 | Data Analysis

Data was cleaned and prior to the analysis, the distribution and statistical assumptions were checked using IBM SPSS Statistics for Windows, version 29 (IBM Corporation 2022). Descriptive statistics (frequencies, percentages, ranges, means and standard deviations or medians/IQR depending on distribution) were used to describe the sample. Missing data was managed by pairwise deletion, to ensure that only those variables with missing data were deleted and that variables with complete data were included (Pallant 2016).

An exploratory model-building approach was used due to the limited research on this topic, removing the reliance on the researcher to select which variables should be entered into the model (Field 2013). In the first phase, simple univariable analyses were undertaken to assess the bivariate relationship between the categorical dependent variable (PIP education within 24 h: dummy coded 0 = No; 1 = Yes) and each of the eight candidate predictor variables (Table 2). The purpose of the first phase of analysis was to identify variables that could potentially predict the outcome univariably. In the second phase, only those variables that were statistically significant ($p \leq 0.10$) univariable predictors of the outcome variable (PIP education within 24 h of hospitalisation) (Field 2013) were simultaneously included in a multivariable logistic regression model. The purpose of the second phase analysis was to determine the predictive power of the candidate predictors over and above (i.e., independent of) the other univariable predictors (sometimes referred to as independent predictive power) (Riley et al. 2013). The model was assessed in relation to variance tolerance levels and inflation factors, and an absence of multicollinearity was indicated. Due to this research being hypothesis-generating, a lenient statistical significance threshold of 0.1 was chosen to reduce the risk of incorrectly rejecting true predictors.

5 | Results

5.1 | Characteristics of the Sample

The sample of 300 participants ($n = 150$; 50% from each site) comprised more males ($n = 199$; 66.3%) compared to females (Table 3). The mean participant age was 65.9 years (SD 10.7), whilst the mean BMI score was 29.5 (SD 6.2), considered overweight. Close to one-third ($n = 106$; 31%) of participants had ≥3 comorbidities, whilst almost two-thirds ($n = 194$; 64.7%) were surgical admissions compared to medical. The average hospital

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length of stay was 5.0 (IQR 3.0–8.0) days. All 300 (100%) participants had a Waterlow risk assessment completed by the research nurse prior to recruitment, enrolment and group allocation. In total, 153 (51%) of patients were considered 'at-risk' of PI with a Waterlow score between 10 and 14. Seventeen (5.7%) patients, most of whom were surgical admissions ($n = 13$; 76.4%), received PIP education from nurses in the first 24 h of their hospital stay.

In Phase 1, univariable analysis of the outcome variable *PIP education received within 24 h* resulted in two predictor variables being statistically significant ($p < 0.10$); BMI ($p = 0.011$) and Waterlow score ($p = 0.066$) (Table 4). BMI as a continuous variable was used based on the exploratory nature of this study.

TABLE 4 | Univariate analysis.

Predictors	Odds ratio	95% CI		*p*
		Lower	Upper	
Organisational				
Hospital site	0.527	0.190	1.463	0.218
Clinical				
Admission type	1.301	0.480	3.523	0.605
Patient				
Age	0.970	0.928	1.014	0.185
Sex	0.711	0.262	1.926	0.502
Body mass index score	1.089	1.016		**0.011**
Total number of comorbidities	1.133	0.778	1.651	0.351
Number of high-risk medications	1.335	0.419	4.258	0.625
Completed risk assessment	0.702	0.192	2.560	0.592
Waterlow score	1.089	0.973	1.220	**0.066**

Note: Bold values indicate that the predictors for the delivery of PIP education by nurses in the first 24hrs of hospital admission are the ONLY results of significance from all predictors at a univariate level.
Abbreviation: CI, confidence interval.

There were no other statistically significant hospital site, clinical or other patient factors (Table 4).

The subsequent multiple logistic regression model tested the outcome variable—*PIP education received within 24 h* and the two significant predictor variables BMI and Waterlow score (Table 4). The Hosmer–Lemeshow Goodness of Fit Test was significant (0.507), suggesting support for the model. One predictor was statistically significant in influencing the delivery of PIP education within the first 24 h of admission in this sample (Table 5); the patient factor of BMI (OR 1.09 [95% CI: 1.02; 1.17]; $p = 0.016$). BMI is correlated with the Waterlow score and hence some information about the Waterlow score can be deduced from BMI. These results indicate that the Waterlow score did not add additional predictive power over what was already provided by BMI. The results suggest that the odds of receiving patient PIP education were 1.09 times larger with each one-unit increase in BMI. Hence, the model indicates as BMI rises, the greater the odds of medical and surgical patients receiving PIP education from nurses within 24 h of hospital admission.

6 | Discussion

We found few episodes of medical and surgical participants receiving PIP education soon after admission. In this exploratory study, BMI score was the only independent predictor of the delivery of patient PIP education within the first 24 h of hospital admission by nurses.

6.1 | Low Level of Patient Pressure Injury Education Within the First 24 h of Hospital Admission

The low rate 5.7% of patient PIP education received from acute care nurses in our study is congruent with most other research in this area (1.4% to 36.7%) (Deakin et al. 2020; Chaboyer et al. 2017; Li et al. 2021a, 2021b; Latimer et al. 2016). For instance, a 2017 multisite Australian study of 241 patients found only 11% of medical charts had documented evidence of patient PIP education (Latimer et al. 2016), whilst only four out of 180 (2%) patients in an Irish and Norwegian hospital study received PIP education (Moore et al. 2015). However, in contrast, Lommerzheim et al. (2024) found 45% of patients ($n = 141$) received initial PIP education in an acute care Australian hospital, which was delivered via receipt of a comprehensive PIP information booklet provided on admission and available at the patient's bedside during their HLOS (Lommerzheim et al. 2024). While the clinical context of our study and that of Lommerzheim et al. (2024) are similar, the difference between our findings

TABLE 5 | Predictors for patient pressure injury education delivered by nurses within 24 h of hospital admission—Multiple logistic regression.

Patient predictors	*β*	SE	Odds ratio	95% CI		*p*
				Lower	Upper	
Body mass index score	0.086	0.035	1.089	1.016	1.168	0.016
Waterlow score	0.034	0.066	1.034	0.908	1.178	0.610

Abbreviations: CI, confidence interval; SE, standard error; Nagelkerke $R^2 = 0.051$.

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(5.7% vs. 45%) may be due to their collaborative approach to PIP education, with both ward nurses and occupational therapists having the responsibility to provide initial and ongoing education throughout the patient's HLOS. Wan et al. (2023) found that nurse-led multi-disciplinary care facilitated the implementation of preventative evidence-based PI care across various health disciplines in the acute care setting. Whereas our study sought a one-off self-reported participant response (not nurses) on the receipt of PIP education from nurses in the first 24 h of hospital admission. However, the sample size ($n = 300$) in both studies was similar, and similar data collection methods were employed via patient records and comparable patient demographics (such as comorbidities, Waterlow score and HLOS) (Lommerzheim et al. 2024). It is plausible that patients in our study may have a varied recollection of the education received by nurses during the initial 24-h period of hospital admission, potentially impacting our findings by underestimating the number of patients who received PIP education. Evidence suggests nurses educate patients during episodes of care (Deakin et al. 2023); however, this activity may not be documented in the medical file or recognised by patients as 'education' (Wan et al. 2023; Latimer et al. 2021).

The international clinical practice guidelines recommend the delivery of patient PIP education as soon as possible after admission (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). Whilst several authors recommend regular opportunities should be provided for educating patients to enhance the delivery of PIP strategies (Lommerzheim et al. 2024; McInnes et al. 2014; Barakat-Johnson et al. 2019), our prior research found the optimal frequency is unknown (Deakin et al. 2023). Patient PIP education is a recognised patient safety strategy that can help to reduce HAPI incidence (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019), with nurses, nurse managers, and healthcare organisations responsible for finding easy and sustainable approaches to its implementation. Conceivably, nurses in our study may be providing information in the initial 24 h of admission; however, patients may not remember the information provided by nurses during this time. In the first 24 h of admission, patients receive a large volume of new information (Latimer et al. 2021) which can be overwhelming due to high acuity needs (Latimer et al. 2021) and heightened levels of pain or discomfort (Wan et al. 2023; McInnes et al. 2014). It is possible that if we asked our study participants to report PIP education received throughout their total HLOS (admission to discharge) the results may have been different.

Nurses and patients value PIP education yet several barriers exist (Latimer et al. 2021). Nurse-related barriers in the provision of patient PIP education delivery are well identified in the literature, including high workloads (Wan et al. 2023; Deakin et al. 2023), a low order priority (Wan et al. 2023; Latimer et al. 2021; Deakin et al. 2023; Barakat-Johnson et al. 2019) and workplace culture (Deakin et al. 2023). In fast-paced acute care wards, higher priorities may be placed on performing daily nursing tasks, with providing patient education considered a low priority task (Wan et al. 2023; Latimer et al. 2021; Deakin et al. 2023; Barakat-Johnson et al. 2019). In addition to nurse-related barriers, Latimer et al. (2021) state that PI knowledge and awareness in hospitalised patients are lacking. Conversely, in another study, the concept of PI was well understood in over eight out of 10 acute care patients (McInnes et al. 2014). With such diversity in the acute care patient cohort, tailored education resources are needed to guide nurses in the consistent delivery of PIP education to patients (Deakin et al. 2020, 2023; Latimer et al. 2021). Moreover, our 2023 integrative review (Deakin et al. 2023) highlighted that where clear and accessible instructions and resources to guide nurses in patient PIP education practice are lacking, implementation is limited and ad hoc at best. This may lead to a gap between using prevention strategies to enhance a patient's health literacy and active participation in their preventative care. Further research is recommended to explore nurses' perceptions and responsibilities, including barriers (e.g., time and workload) and facilitators (e.g., access to education resources) for delivering PIP education within the first 24 h of admission in acute care settings.

6.2 | Patient Factor—Body Mass Index Score

BMI score was the only statistically significant predictor for the receipt of PIP education within the first 24 h of hospital admission in this study. Specifically, as the patients BMI rises, this is associated with greater odds of receiving PIP education by nurses soon after admission. BMI is a known risk factor for PI development (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019; Ness et al. 2018; Chen et al. 2023); however, to the best of our knowledge, this is the first study that has identified a patient's increasing BMI as a potential predictor for the receipt of patient PIP education within the first 24 h of admission by acute care nurses. This is a significant finding, as this may help to understand nurses early delivery of preventative education practices (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019; Latimer et al. 2014), as commonly a patient's BMI forms part of early risk assessments conducted in the first 8 h of admission (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). Moreover, as a patient's BMI increases, they are at increased risk of PI development due to increased pressure over bony prominences including the sacrum, expediting the risk of skin breakdown when prolonged periods of immobility are experienced (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). However, replication studies are required to confirm that as a patient's BMI rises, as suggested in this study, nurses are at increased odds of delivering PIP education during patients' early stages of admission (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019).

Patients who have a higher BMI may find it difficult to move around in bed and be less mobile overall, hence targeted and early PIP education may highlight the importance of offloading and repositioning (European Pressure Ulcer Advisory Panel

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(EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019), and may improve participation in their own preventative care (Latimer et al. 2021). Marshall et al. (2024) found no link between a higher BMI and PI in a review of 42 studies. However, research on 2632 ICU patients indicated higher PI incidence with both underweight and overweight BMIs (Hyun et al. 2014). However, for both studies, the correlation between BMI and the delivery of preventative PIP education was not reported (Marshall et al. 2024; Hyun et al. 2014). Similarly, a 2024 dose–response analysis (Jia et al. 2024) of 11 international studies involving over 31,000 patients across various departments including ICU, acute care surgical, and long-term care facilities found a correlation between under and overweight patients and the development of PI. Specifically, nine of the studies accounting for over 15,000 patients reported obese patients (particularly the elderly) were more likely to develop PI, compared to those of normal weight, although a correlation to patient education was not reported (Jia et al. 2024). Whilst completion of a PI risk assessment is a precursor to preventative interventions such as patient education (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019), a rising BMI in isolation has not correlated specifically to the delivery of education by acute care nurses in prior research.

A patients' BMI has been used by health practitioners for many decades to assess whether a person is underweight (<18.5), health weight (18.6–24.9) or is overweight (>25) (WorldHealthOrganisation 2010). However, BMI has recently come under scrutiny due to the lack of cultural and demographic generalisability and discourse regarding the relevance of measuring weight and health (Gutin 2018). Given that the use of BMI varies across countries globally, drawing conclusions based on a patients BMI alone is problematic (WorldHealthOrganisation 2010). Nurses may view patients who are overweight as being at an increased risk of PI and therefore place importance on implementing PIP strategies for this cohort of patients (Marshall et al. 2024; Hyun et al. 2014). Whilst it is commonly reported in specialist areas such as ICU, a rising BMI predicting receipt of PIP education by acute care patients is a new finding. While our findings may reflect appropriate targeting given the increased risk of PI in individuals with higher BMI (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019), it also raises questions about the consistency and equity of education provided to all at-risk patients. Notwithstanding, we advise caution in interpretation of this result as there was only a one-off observation within the initial 24-h period of admission.

6.3 | Hospital Site, Clinical, and Nurse Related Factors

We found no significant relationship between hospital Site (A or B) or clinical factors (admission type; medical vs. surgical) and PIP education delivery within 24 h of admission. These results contrast with research highlighting variations in PIP practices across hospitals and ward settings. For example, Gunningberg et al. (2012) compared PIP care in two Swedish hospitals to over 200 hospitals in the USA, with significantly lower rates of PIP care recorded in Swedish hospitals. With respect to the availability of resources, Team et al. (2020) found only 34.5% of 212 hospitals in Australia had PIP education resources such as brochures and videos; hence, contextual and clinical factors may inhibit PIP education measures and important foci of future research. Nurses have reported a need for better patient PIP education resources in the hospital setting to facilitate PIP delivery (Wan et al. 2023; Latimer et al. 2021; Deakin et al. 2023). In addition, nurses in Wan et al. (2023) systematic review lacked the knowledge and skills to enhance patient involvement in PIP, with organisational barriers as a key factor. Importantly, improvements to both resource and clinician skill development have been identified as crucial to the nurse–patient relationship for facilitating PIP education (Wan et al. 2023; Latimer et al. 2021). Perhaps this may provide insights into the few episodes of PIP education delivery found in our study—hence, the impact of an area for further research.

Patients are an underutilised resource in their care. In an environment where nurses are time-poor (Wan et al. 2023; Deakin et al. 2023), encounter scarce allocation of resources and have trouble in accessing up-to-date PIP guidelines (Wan et al. 2023), prevention measures are considered a low-order priority (Wan et al. 2023; Latimer et al. 2021; Deakin et al. 2023; Barakat-Johnson et al. 2019); hence patients may play a proactive role in their PIP care (Chaboyer et al. 2017). However, patient barriers such as literacy and sensory impairments, are underexplored (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). Evidence-based education materials, including written and video materials, help bridge these gaps, enhancing both nurse and patient engagement in PIP (Young 2021; Roberts et al. 2016; Deakin et al. 2020; Latimer et al. 2021; Schoeps et al. 2017). Moreover, significant improvements to patients' knowledge of, and participation in PIP care were found in two before and after studies pertaining to multi-modal education delivery (Deakin et al. 2020; Schoeps et al. 2017). In addition to encouraging patient autonomy and increasing participation in their care, educating patients about PIP may also improve patient safety and care satisfaction by preventing adverse events (Latimer et al. 2014). However, nurses remain uncertain about PIP implementation (Wan et al. 2023). Further research is warranted to explore how educational resources may enhance the patient PIP education (Deakin et al. 2020, 2023) processes adopted by nurses, in terms of facilitating the teaching of PIP education to patients in the acute care setting.

6.4 | Strengths and Limitations

Our study findings are relevant to the Australian healthcare context, which is a major strength. Importantly, with both study sites being large metropolitan tertiary teaching hospitals and adopting similar policies, processes and staffing, this is considered a strength of this research. Similarly, this sub-study is based on a larger randomised control trial, and hence methodological rigour is a strength due to clear and consistent methods for recruitment, data collection between sites, and extensive training of research nurses. Yet, we acknowledge some limitations. Firstly, our study is based on a trial undertaken in two

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Australian hospitals with strict recruitment criteria (such as excluding patients with existing PI or incontinence); hence, they may not be representative of the general medical/surgical population. Moreover, this study included the first 150 control group patients only from both Site A and B in the parent trial (Walker et al. 2023); therefore, we do not know if the group at either site received PIP education. However, all patients in the study were asked if education was received. Notwithstanding, we have captured a wide range of medical and surgical patients across two large hospital sites and 20 wards during this research. Secondly, the accuracy of the data was reliant upon information contained in electronic databases, medical charts, and nursing care plans; thus, some of the data may be inaccurate or missing. Thirdly, this research was based on an observational study, and whilst we identified only one factor associated with PIP education delivery in the first 24 h, we cannot exclude other possible factors such as mobility/activity, nutritional status, and the presence of preexisting PI that may have contributed. This may include improved patient safety practices such as PIP adopted by hospitals during COVID-19, which may have impacted on the results. Finally, this study was exploratory in nature; hence, there may be other predictors of PIP education delivery, such as resource barriers, nutrition, or independent PI predictive factors, including patients' mobility/activity status that were not explored in this study. Moreover, we acknowledge that whilst we explored factors such as hospital site, there were no other organisational factors compared in this study.

6.5 | Recommendations for Further Research

Most of the existing research predicts patient variables such as mobility/activity, nutritional status, BMI or Waterlow score to the development of PI (European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA) 2019). The most frequently reported prevention strategies are mobilisation or regular repositioning as a single intervention, with patient education in PIP consistently reported as the least implemented preventative strategy. Therefore, a more nuanced understanding of clinical and patient factors that predict a patient's likelihood of receiving education as a preventative intervention within the first 24 h of acute care hospitalisation is required. Additionally, patients remain an underutilised resource in the busy acute care ward, often exhibiting help-seeking behaviours in their care. Hence, future research should explore the barriers and facilitators nurses encounter in the provision of PIP education within the first 24 h of patient hospital admission. In addition, further research including alternative predictive factors influencing PIP education delivery in acute care may support nurses, managers, and organisations in providing evidence-based PIP education to improve the delivery of and patient participation in patients PIP care. Finally, understanding how the delivery of patient education impacts the incidence of pressure injury development in the patient population should be explored.

6.6 | Implications for Policy and Practice

To the best of our knowledge, this is the first study that identifies a rising BMI as one predictor for patients' receipt of PIP education within the first 24 h of hospital admission. Low levels of patient PIP education mitigate delivery of personalised care, which may decrease patients' participation and help-seeking PIP care behaviours that may result in poorer PIP outcomes. Whilst nurses consider many factors when implementing PIP, patients with a higher body mass index were more likely to receive PIP education from nurses in this study. This finding may help to understand nurses PIP priorities in the first 24 h of a patient's admission, their current clinical education practices, and provision of risk-based care. While this may reflect appropriate and targeted nursing care, given the increased risk of PI in individuals with higher BMI, it further elicits questions about the consistent and equitable delivery of education to all at-risk patients. Recognising this trend may inform the development of more standardised and inclusive patient education protocols to ensure that prevention efforts are not inadvertently limited to specific patient subgroups. It also highlights the importance of ongoing training and support for nurses to assess and address PI risk comprehensively, beyond single risk factors such as BMI. Therefore, understanding how nurses approach education delivery, including the content and timing of education delivery, warrants further study. If confirmed in replication studies, this has the potential to improve evidence-based PIP education practice implementation for the acute care population.

7 | Conclusion

This study found few episodes of education delivery for PIP in the acute care environment—a finding consistent amongst global literature. In addition, our study found that hospital site and clinical factors (ward setting) did not predict nurses' delivery of PIP education within the first 24 h of admission. Whilst we acknowledge many factors predict the development of PI such as impaired mobility and nutritional status, our study provides new insights into one potential predictor of PIP education delivery by nurses within the Australian acute care hospital setting. An increasing BMI was found to predict the receipt of patient PIP education within the first 24 h of hospital admission in this study—a new finding. However, the overall delivery rate of PIP education within our sample remains low a—consistent finding. Further research is warranted to determine if additional predictive factors in the acute care setting (such as mobility and nurses' knowledge) help nurses' and patients' behaviours in PIP education and reduce adverse healthcare outcomes based on a larger sample size. Moreover, understanding the barriers and facilitators to the delivery of patient PIP education within the first 24 h of hospital admission is warranted.

Author Contributions

Jodie Lee Deakin: writing – original draft, methodology, investigation, formal data analysis, conceptualisation. **Sharon Leanne Latimer:** writing – reviewing and editing, supervision. **Brigid Mary Gillespie:** writing – reviewing and editing, supervision. **Rachel M. Walker:** writing – reviewing and editing, supervision. **Brett Dyer:** writing – reviewing and editing of analysis and results.

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Conflicts of Interest

The following conflicts are disclosed by the authors. Author Deakin was employed as a Clinical Research Nurse for the EEPOC Trial (parent trial – Australia New Zealand Clinical Trials Registry; ACTRN12619000763145) (Pallant 2016).

Data Availability Statement

The data are not publicly available as per ethics requirements.

Peer Review

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1111/jan.70181.

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