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ORIGINAL ARTICLE

Malnutrition is independently associated with skin tears in hospital inpatient setting—Findings of a 6-year point prevalence audit

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Skin tears cause pain, increased length of stay, increased costs, and reduced quality of life. Minimal research reports the association between skin tears, and malnutrition using robust measures of nutritional status. This study aimed to articulate the association between malnutrition and skin tears in hospital inpatients using a yearly point prevalence of inpatients included in the Queensland Patient Safety Bedside Audit, malnutrition audits and skin tear audits conducted at a metropolitan tertiary hospital between 2010 and 2015. Patients were excluded if admitted to mental health wards or were <18 years. A total of 2197 inpatients were included, with a median age of 71 years. The overall prevalence of skin tears was 8.1%. Malnutrition prevalence was 33.5%. Univariate analysis demonstrated associations between age ($P < .001$), body mass index (BMI) ($P < .001$) and malnutrition ($P < .001$) but not gender ($P = .319$). Binomial logistic regression analysis modelling demonstrated that malnutrition diagnosed using the Subjective Global Assessment was independently associated with skin tear incidence (odds ratio, OR: 1.63; 95% confidence interval, CI: 1.13-2.36) and multiple skin tears (OR 2.48 [95% CI 1.37-4.50]). BMI was not independently associated with skin tears or multiple skin tears. This study demonstrated independent associations between malnutrition and skin tear prevalence and multiple skin tears. It also demonstrated the limitations of BMI as a nutritional assessment measure.

KEYWORDS

malnutrition, nutrition status, risk factor, skin tear, skin tears

1 | INTRODUCTION

Skin tears are a significant health issue, with skin tear prevalence from 3.3% to 24% across populations, including acute care, home care, and long-term care.[1,2] Increased pain, chronic wound development, hospital length of stay, economic costs, reduced mobility, and reduced overall quality of life are associated with skin tears.[3,4] However, skin tears appear to be an understated, under-researched injury, and the cost of skin tears on patients and the broader health care system appear undervalued.[5,6]

Skin tears can occur at any life stage and on any part of the body; most are commonly found in neonates and older adults in the extremities.[7,8] Blunt trauma during transfers, bathing, or falls are acknowledged as primary contributors; however, in up to 50% of cases, the aetiology of skin tears is unknown.[9–11] Multiple risk factors for the development of skin tears have been identified, including advanced age, history of skin tears, assistance with activities of daily living, impaired cognition, and dry or bruised skin.[1,2,12] In addition, many older adults have comorbidities that can contribute to polypharmacy, an identified skin tear risk factor, as well the taking of medications such as steroidal and non-steroidal anti-inflammatory drugs, which can compromise skin integrity.[2,8]

Research has found the prevalence of protein energy malnutrition (malnutrition) within hospitalised individuals

within Australia (and internationally) to be typically 20% to 35%.[5,13–16] The relationship between pressure injuries and malnutrition has been well established within acute, long-term, and home care settings; malnutrition is identified as the most strongly associated nutritional risk factor for development and severity.[17–20] The association between malnutrition in pressure injuries is thought to be multifactorial, with an increase in bony prominences in malnourished patients and poorer skin integrity (tensile strength, nutrient delivery, oxygenation, loss of underlying fat, and dermal thickness,). However, there is minimal literature exploring the association of skin tears and malnutrition, with only 1 study reviewing key macro- and micronutrients.[21–25] Small studies in specific populations suggest an association between skin tears and rudimentary measures of nutritional status, such as malnutrition nutrition screening tools, low body mass index (BMI), or feeding protocols.[5,9,26] In the absence of comprehensive supporting evidence, international consensus recommendations/treatment guidelines note the need to optimise nutrition and hydration for the prevention of skin tears.[25,27–29] Consequently, there is a need to explore this association using robust measures of nutritional status and to account for potential confounding factors.

Although there is no gold standard for malnutrition diagnosis, diagnostic accuracy studies and international guidelines recognise the Subjective Global Assessment (SGA) as a valid, reliable, sensitive, and specific measure to determine nutritional status in hospital inpatients, and it has been used in similar studies related to pressure injuries.[20,30–34] To assess nutrition status, the SGA involves an individual assessment of weight history, dietary intake, gastrointestinal symptoms, and functional capacity, combined with a physical assessment of subcutaneous fat, muscle wasting, presence of oedema, and ascites related to malnutrition.[34] This measure is suggested to have higher concurrent and predictive validity then other measures applied in older hospitalised inpatients.[30]

Inadequate nutrition and hydration has been suggested as a modifiable intrinsic risk factor for skin tears in multiple studies.[25,35,36] Demonstration of an independent relationship between malnutrition and skin tears may support clinical practice interventions. These interventions may inform changes to reduce the prevalence and incidence of skin tears and improve the management of skin tears in the hospital setting. Therefore, this study aims to determine if there is an association between malnutrition and skin tears in hospital inpatients.

2 | METHODS

A cross-sectional study design was used to evaluate pooled data from 6 single-day annual point prevalence audits. A convenience sample of all audits conducted between 2010

Key Messages

- skin tears and malnutrition are both separately recognised as predictors of adverse patient and health care outcomes
- the relationship between skin tears and malnutrition is not well described to date
- this study including 2197 inpatients demonstrates an independent association between malnutrition diagnosed using the Subjective Global Assessment and skin tear prevalence, as well as an association with multiple skin tears
- findings also demonstrate limited association between body mass index and skin tears

and 2015 across all wards of a 600-bed metropolitan tertiary hospital in Brisbane, Australia, was available for evaluation. All hospital inpatients ≥18 years of age were invited to participate in each yearly audit. Demographic and clinical information data (age, gender, ward location, height, weight, nutritional status, and BMI) were collected using standard templates by trained staff for all admitted inpatients hospital-wide on a single day. The Queensland Patient Safety Bedside Audit (QBA) was conducted by trained auditors; malnutrition audit data (SGA, height, and weight) were collected by trained dieticians; and skin tear data were collected by trained nurses and then confirmed and classified by specialised wound management nursing staff. Dieticians undertook SGA workshops and inter-rater reliability training prior to the audit day (ranging from 75% to 100%). Weight and SGA rating data were collected only if it had been recorded within a week of the date of audit to ensure accuracy.

Patients with missing variables, for example, those who did not consent to participate in the malnutrition assessment, were included in the final sample. Missing data were obtained from patient medical records retrospectively, using weight/height/SGA data documented within 7 days on either side of audit day, as part of a previous ethics-approved study.

Nutrition status was diagnosed using SGA, with patients classified as well nourished (SGA A), mild-moderately malnourished (SGA B), or severely malnourished (SGA C). Patients "at risk" or "suspected" of malnutrition without adequate supporting evidence were categorised as "A" due to the need to avoid over-diagnosis of malnutrition in a case-based reimbursement funding environment. Patients classified as SGA B or C were then grouped into a "malnourished" category for regression analysis. Patient weight and height were documented on the day of or prior to the audit day and were used to calculate BMI. BMI categories were defined using the World Health Organisation classifications (underweight <18.5 kg/m^2, healthy weight 18.5-24.99 kg/m^2, overweight 25-29.99 kg/m^2, obese 30-39.99 kg/m^2, and morbidly obese >40 kg/m^2).[37]

While there is no current international skin tear classification system accepted and used universally, there are 3 widely used systems: Payne-Martin, Skin Tear Classification System (STAR), and International Skin Tear Advisory Panel (iSTap).[27,38,39] This facility categorises skin tears using the STAR classification system, which defines a skin tear within 5 skin tear categories: 1a: A skin tear where the edges can be realigned to the normal anatomical position (without undue stretching), and the skin or flap colour is not pale, dusky, or darkened; 1b: A skin tear where the edges can be realigned to the normal anatomical position (without undue stretching), and the skin or flap colour is pale, dusky, or darkened; 2a: A skin tear where the edges cannot be realigned to the normal anatomical position, and the skin or flap colour is not pale, dusky, or darkened; 2b: A skin tear where the edges cannot be realigned to the normal anatomical position, and the skin flap or colour is pale, dusky, or darkened; and 3: A skin tear where the skin flap is completely absent.[39]

2.1 | Statistical analysis

Data were analysed using IBM SPSS Statistics for Windows (Version 23, IBM Corp., Armonk, New York). Data analysed included: number of patients in each year's audit, number of patients consenting to be included in audit and data publications, patient demographics (age, gender), number of skin tears, number of skin tears per patient, location of skin tears, skin tear classification, nutrition status, and BMI. Descriptive statistics were entered to describe sample demographics (including median, range, frequency, and percentages). Independent variables (age, gender, location of skin tear, classification of skin tear, nutritional status, BMI category) were assessed by the Pearson's χ^2 test, and for smaller samples (expected cell counts were less than 5), Fisher's exact test was conducted. Logistic regression analysis was conducted to adjust for statistically significant continuous (age, BMI) and categorical variables (gender, nutrition status) and to determine the association of effects with skin tears as the dependent variable reporting odds ratios (ORs) and 95% confidence intervals (95% CIs). Significance was assessed using a P value of .05.

2.2 | Ethics

Ethical approval was granted by The Prince Charles Hospital Research, Ethics and Governance Committee, Approval number [HREC/17/QPCH/71].

3 | RESULTS

A total of 2197 inpatients were included across 6 single-day audits conducted between 2010 and 2015. Demographic characteristics demonstrate a predominantly male, older inpatient population (Table 1).

3.1 | Skin tear and malnutrition prevalence

The overall average point prevalence of patients with skin tears within the hospital setting was 8.1%, averaged over the 6-year period, with no apparent trends in prevalence (5.5% in 2010, 9.3% in 2011, 9.9% in 2012, 6.1% in 2013, 7.7% in 2014, 9.6% in 2015; $\chi^2 = 8.66$; df = 5; P = .124). Malnutrition was diagnosed in 33.5% of patients audited across the 6-year period, with a significant reduction in the point prevalence of malnutrition across these years (45.6% in 2010, 35.2% in 2011, 33.4% in 2012, 30.3% in 2013, 30.1% in 2014, 26.5% in 2015; $\chi^2 = 32.70$; df = 5; P < .001). Although there was a clear association between malnutrition diagnosed using the SGA and BMI ($\chi^2 = 413.221$, df = 4, P < .001), it is important to note that malnourished patients were observed across all BMI categories (Figure 1).

Table 2 demonstrates the association between independent variables of interest and skin tears.

Logistic regression analysis of risk factors associated with skin tears is shown in Table 3. Variance Inflation Factor (VIF) values demonstrated no multicollinearity between

TABLE 1 Demographics and characteristics of documented skin tears

		% (n)
Gender (n = 2197)	Male	54.6% (1200)
	Female	45.4% (997)
Age (n = 2197)	Range (18-99)	—
	Median (71)	—
Skin tear documented (n = 2197)	No skin tear	91.9% (2020)
	Skin tear	8.1% (177)
Skin tears per patient (n = 177)	1 Skin tear	5.0% (109)
	>1 Skin tear	3.1% (68)
Skin tear category (n = 330)	1a	6.4% (21)
	1b	16.4% (54)
	2a	3.6% (12)
	2b	34.8% (115)
	3	38.8% (128)
Skin tear location (n = 330)	Upper extremities	49.4% (163)
	Lower extremities	47.6% (157)
	Back/trunk	1.5% (5)
	Head	0.6% (2)
	Other	0.9% (3)
Nutrition status (n = 2003)	Well nourished (SGA A)	66.5% (1331)
	Mild/moderately malnourished (SGA B)	27.8% (556)
	Severely malnourished (SGA C)	5.8% (116)
BMI category (n = 2130)	Underweight (<18.5 kg/m^2)	7.7% (163)
	Healthy (18.5-24.9 g/m^2)	36.7% (782)
	Overweight (25-29.9 kg/m^2)	27.3% (581)
	Obese (30-40 kg/m^2)	23.8% (506)
	Morbidly obese (>40 kg/m^2)	4.6% (98)

Abbreviations: BMI, body mass index; SGA, Subjective Global Assessment.

Count of malnourished patients per BMI category
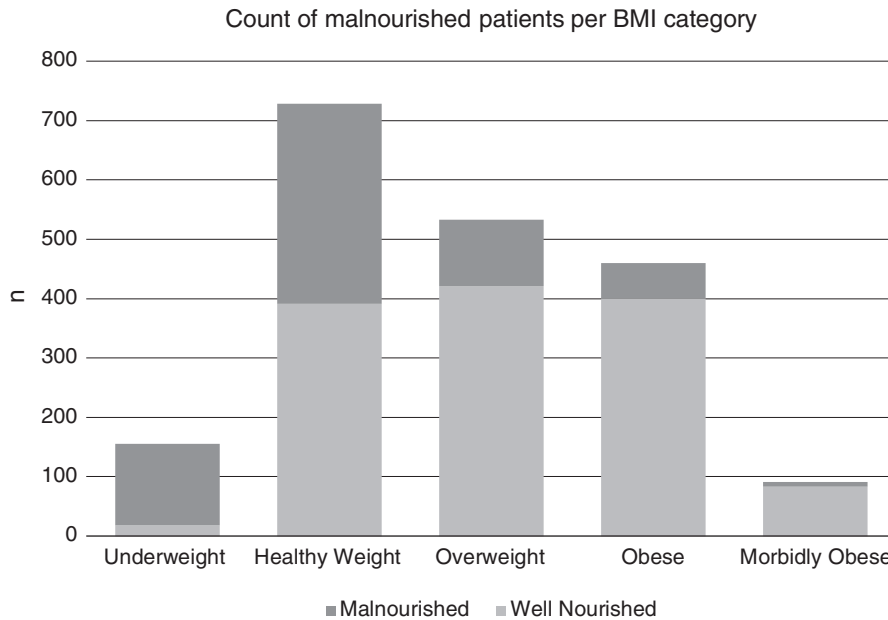
FIGURE 1 Count of malnourished patients per body mass index (BMI) category

variables included in the final logistic regression model. After adjusting for age, gender, and BMI, the logistic regression analysis model demonstrated a statistically and clinically significant relationship between malnutrition and skin tears (Table 3). Increasing age also demonstrated a small but statistically significant positive association with skin tears after adjusting for covariates. BMI was not independently associated with skin tears after adjusting for age, gender, and malnutrition. A second logistic regression model demonstrated that malnutrition was the only covariate associated with the increased risk of multiple skin tears; this model was also significant (Table 3).

3.2 | Malnutrition, location, and classification of skin tear

No significant relationship between malnutrition and the location of skin tears was identified (Fisher's exact test:

TABLE 2 Association between skin tears and independent variables of age, gender, BMI, and malnutrition

Independent variable	Skin tears			Multiple skin tears		
	No	Yes	P	No	Yes	P
Age, median (range; IQR)	69 (18-99; 25)	81 (26-99; 14)	[a] < .001	70 (18-99; 25)	81 (58-98; 14)	[a] < .001
Female, n (%)	923 (45.7%)	74 (41.8%)	χ^2 (1) .991; .319[b]	977 (45.9%)	20 (29%)	χ^2 (1) 7.725; .005[bc]
BMI, median (range; IQR)	25.96 (9.79-107.15; 8.87)	23.73 (12.31-50.87; 6.94)	[a] < .001	25.80 (9.79-107.15; 8.86)	23.90 (15.61-50.87; 6.95)	[a].006
BMI category, n (%)			χ^2(4) 26.299; <.001[b]			χ^2(4) 8.868; .064[b]
<18.5	142 (7.3%)	21 (11.9%)		155 (7.5%)	8 (11.6%)	
18.5-24.9	699 (35.8%)	83 (47.2%)		749 (36.3%)	33 (47.8%)	
25-29.9	533 (27.3%)	48 (27.3%)		563 (27.3%)	18 (26.1%)	
>30	483 (24.7%)	23 (13.1%)		497 (24.1%)	9 (13.0%)	
>40	97 (5.0%)	1 (0.6%)	<.001	97 (4.7%)	1 (1.4%)	
Nutrition status, n (%)			χ^2(2) 34.499; <.001[b]			χ^2(2) 22.930; <.001[b]
SGA A	1253 (68.3%)	78 (46.2%)		1307 (67.3%)	24 (38.7%)	
SGA B	479 (26.1%)	77 (45.6%)		523 (26.9%)	33 (53.2%)	
SGA C	102 (5.6%)	14 (8.3%)		111 (5.7%)	5 (8.1%)	

Abbreviations: BMI, body mass index; SGA, Subjective Global Assessment; IQR, Interquartile range.

[a] Mann-Whitney U-test.

[b] Pearson χ^2 test.

[c] One cell (10.0%) has expected count less than 5. The minimum expected count is 3.17.

TABLE 3 Risk factors associated with skin tears by a multiple logistic regression (n = 1967)

Risk factor	Skin tears[c]				Multiple skin tears[d]			
	OR	95% CI		P value	OR	95% CI		P value
Malnutrition[a]	1.61	1.11	2.34	.011	2.48	1.37	4.50	.003
Age	1.06	1.05	1.08	<.001	1.06	1.03	1.08	<.001
Male	1.47	1.05	2.07	.025	2.41	1.38	4.21	.002
BMI[b]	0.97	0.94	1.00	.066	0.99	0.94	1.04	.754

Abbreviations: BMI, body mass index; CI, confidence interval; OR, odds ratio.

[a] Mild/moderately or severely malnourished.

[b] Underweight.

[c] The overall model was significant (χ^2(4): 133.79; P < .001).

[d] The overall model was significant (χ^2(4): 59.03; P < .001).

df = 4, P = .673); however, there was only a limited number of patients with skin tears on the head (n = 1), back/trunk (n = 3), and other (n = 2). There was no association between skin tear classification and malnutrition (χ^2 = 2.159, df = 4, P = .707).

4 | DISCUSSION

This study found a significant relationship between malnutrition and skin tears, as well as malnutrition and multiple skin tears within a large metropolitan tertiary facility. BMI was not associated with a significantly increased risk of skin tears. Clinical guidelines state that the best way to manage skin tear prevalence is prevention; however, limited research has been conducted focusing on modifiable risk factors such as malnutrition and BMI.[4,40]

Malnutrition was the variable most likely to increase the odds of skin tear development of those patients analysed. Identifying patients at risk of malnutrition early in admission and trained staff undertaking a comprehensive nutrition assessment, such as an SGA, is important to reduce patient harm and costs to the health care system.[17,41] Identification of modifiable risk factors for skin tears, such as malnutrition, is useful to highlight the need for the implementation of risk mitigation strategies (eg, manual handling precautions, dressing types), which may further contribute to improving patient care, preventing harm, and reducing health care costs. Nutrition is important for not only the prevention of skin tears but also its management, and nutrition should be optimised to heal any wounds, especially those that have developed into chronic wounds.[42] Several studies state dietetic consultation as a beneficial strategy for skin tear prevention and management in order to promote and monitor adequate nutrition and hydration.[8,25,28,36,43,44] This study further supports the role of nutrition in the prevention and management of skin tears. Findings also highlight a significant reduction in the point prevalence of malnutrition over the 6-year period; these findings are the subject of a separate manuscript for future publication.

The findings of this study reflect the work within pressure injuries with Banks et al,[18] Ness et al,[15] Iizaki et al,[17] and Baumgarten et al[19] who found ORs of 1.8 to 2.6 of developing a pressure injury in moderately malnourished patients up to 5 OR in the severely malnourished patient group. While the study showed malnourished patients to be more likely to develop multiple skin tears, malnutrition was not correlated with skin tear category.

This study found that BMI was not independently associated with skin tear development. It is common thinking that malnourished patients are low of body weight; however, this study clearly displays that a patient can be malnourished at any BMI category (Figure 1). A lower BMI is associated with a reduction in adipose tissue in various locations around the body, including the extremities. However, BMI is not a reliable indicator of adiposity in individuals as it does not take into account differentiations between populations, with factors such as fluid retention and muscle mass.[45] Sanada et al[26] found that a lower BMI (17 kg/m^2 compared to 17.6 kg/m^2) correlated to skin tear incidence, but this was not the case for this cohort.

Although the goodness of fit was statistically significant when identifying the relationship between skin tears and malnutrition, it is presumed that pressure injuries and skin tears share similar characteristics in terms of skin integrity. However, these claims are yet to be substantiated with comprehensive evidence, and future research should focus on these knowledge gaps.[40] Potential variables of interest include: history of skin tears, assistance with activities of daily living, impaired cognition, dry skin, bruised skin, medications and polypharmacy, inadequate nutritional intake, inability to feed oneself, poor appetite, dehydration, comorbidities, reason for admission, primary diagnosis, mobility, and Braden Score.[1,5,12,46]

Advanced age is a well-defined risk factor for skin tears and is an important consideration with Australia's aging population where the number of people aged over 65 years will rise to 18% in 2021 and 26% in 2051.[39] Aging leads to structural skin changes, including reduced dermal thickness, elasticity, loss of underlying fat, resilience, and increased dryness increasing susceptibility to injury.[22,47–49] Due to these physiological changes, people aged 70 to 75 years are twice as likely to develop pressure injuries as those aged 55 to 69 years.[50]

The results of this study reflect a review article by Rayner et al[12] that examined the location of skin tears, with upper extremities being the most frequent skin tear location. The only variation with this study was a smaller number of skin tears in the head (0.6% compared to 3-4% in other studies) (Table 1). There was no significant difference identified between nutritional status and location of skin tears; however, this lack of significance may be subject to type 2 error due to small numbers in specific categories (head, back/trunk, other). The results also displayed no significant relationship between nutritional status and skin tear classification. This may be due to the skin tear classification system

not directly denoting severity as it does with pressure injuries but rather being a measure of skin loss.[17,18]

This study has multiple strengths, particularly a complete regression analysis dataset approaching 2000 patients across an entire tertiary hospital population demographic. All diagnoses and classifications for malnutrition and skin tears were standardised and validated and were only conducted by trained health professionals at the large metropolitan teaching hospital. Minimal data (8.8%) were missing data, displaying the rigorous data collection techniques on audit dates. However, limitations of this study include the inability to adjust for reason for admission, primary diagnosis, or comorbidities as these may also substantially impact skin tear point prevalence. Ideally, a Charlson comorbidity index would have been used to adjust for these factors; however, these data were unavailable for the study. Further work is being undertaken by the authors to consider the impact of additional variables of interest, such as specific pharmaceutical products and/or polypharmacy in general, on skin tears. The cross-sectional point prevalence methodology precluded the identification of incident data for both malnutrition and skin tears and also the identification of causality as whether malnutrition was prevalent prior to skin tear was not able to be determined.

5 | CONCLUSION

This sizeable study provides evidence that malnutrition and skin tears are independently associated after adjusting for age and BMI. Malnutrition was also independently associated with patients obtaining multiple skin tears. Findings highlight the importance of malnutrition identification and appropriate nutrition care practices as frontline measures to minimise the impact of skin tears on patients and the health care system more broadly.

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