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EMPIRICAL RESEARCH QUANTITATIVE

Reporting accuracy of pressure injury categorisation in an acute tertiary hospital: A four-year analysis

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Abstract

Aim: To determine the reporting accuracy of pressure injury categorisation by bedside clinicians, compared with nurse experts.

Background: Pressure injuries are an enduring complication of hospitalisation. The categorisation of pressure injury affects treatment and management decision-making and use of resources, and severe hospital-acquired pressure injury incidence is used to benchmark quality of care. However, it is unclear how accurately pressure injuries are categorised by clinicians in practice.

Design: Secondary analysis of hospital pressure injury incident and validation data.

Methods: All pressure injuries reported in adults between 2016 and 2019 that were subsequently validated by nurse experts were analysed. Absolute agreement is reported using percentages, with inter-rater agreement reported using Kappa measure of agreement. The GRRAS reporting guideline was followed.

Results: Of 6186 pressure injuries that were analysed, the category was reported correctly in 67.3% ($n = 4163$), with an overall moderate level of inter-rater agreement by category ($K = .567$, $p < .001$). Of those found to be non-pressure injuries when validated (18.3%, $n = 1129$), most were reported originally as stage II (41.2%, $n = 465$) or stage I (30.5%, $n = 344$), and 13.4% ($n = 151$) were categorised initially as unstageable. The majority reported initially as stage I, stage II, suspected deep tissue injury or mucosal pressure injury were validated, whereas half of those reported initially as stage III or IV were validated and less than a third of those reported initially as unstageable pressure injuries were validated.

Conclusions: This study provides important insight into the accuracy of pressure injury categorisation. Whilst moderate agreement of categorisation was found between reporting clinicians and nurse experts, pressure injury differential diagnosis and categorisation of severe injuries were inadequate.

Relevance to Clinical Practice: These results may be used for benchmarking and provide a focal point for future education and practice improvement efforts.

Patient or Public Contribution: Neither patients nor the public were directly involved in the project.

KEYWORDS
classification, data accuracy, diagnosis, hospitals, nursing assessment, pressure injury, pressure ulcer

1 | INTRODUCTION

Pressure injuries (PIs) have been defined internationally as 'localised damage to the skin and/or underlying tissue, as a result of pressure or pressure in combination with shear' (EPUAP et al., 2019, p. 16). They often develop on a bony prominence but may also occur elsewhere on the skin or mucous membranes of the body (EPUAP et al., 2019). The PI severity and the extent of tissue damage should be classified and documented using a classification system (EPUAP et al., 2019). There are numerous classification systems which have been used globally (EPUAP et al., 2019; Kottner et al., 2020), with one commonly used system being the International National Pressure Ulcer Advisory Panel (NPUAP)/European Pressure Ulcer Advisory Panel (EPUAP) Pressure Ulcer Classification System (NPUAP et al., 2014). The system was first published in 2009 (NPUAP & EPUAP, 2009), and has since been reviewed in 2014 (NPUAP et al., 2014) and 2019 (EPUAP et al., 2019). Whilst PI progression or deterioration is not necessarily linear (Edsberg et al., 2016), the international system classifies *skin* PI into six categories (NPUAP et al., 2014); with the review of 2019 (EPUAP et al., 2019) adopting use of the term pressure *injury* and clarifying the categorisation of mucous membrane PI (see Table 1). However, in the United States, there are some differences in PI terminology. In 2016, NPUAP (now NPIAP) updated its classification system, also using the term pressure *injury*, using Arabic rather than Roman numerals to denote the four stages, and removing 'suspected' from suspected deep tissue injury among other revisions to definitions (Edsberg et al., 2016). Both recent publications (Edsberg et al., 2016; EPUAP et al., 2019) note that mucous membrane PI should be categorised separately and should not be categorised using skin classification systems due to inherent differences between skin and mucosal tissue. For reasons described above, the term 'category' rather than 'stage' is used to describe the classification of PIs throughout this paper.

Pressure injuries that develop during hospitalisation are considered to be mostly preventable and are a patient safety concern given their association with harm and consequence for patients, carers and facilities (Burston et al., 2022; Fernando-Canavan et al., 2021; Nghiem et al., 2022). Thus, within hospitals, PI rates are usually monitored and reported and, in some countries, financial penalties are imposed on facilities for the development of hospital-acquired and severe PIs (Centres for Medicare & Medicaid Services, 2022; Independent Health and Aged Care Pricing Authority, 2022; Jackson et al., 2016; Padula et al., 2020). As such, when a PI is identified in a hospitalised patient, its aetiology, location and category should be accurately documented, along with whether it was facility-acquired or present-on-admission.

A systematic review of PI in hospitalised adults found a global pooled prevalence and incidence rate of 12.8% and 5.4 per 10,000 patient days, respectively, whilst the hospital-acquired PI rate was 8.4% (Li et al., 2020). Across studies reporting PI categories, stages I and II were most common overall (43.5% and 28%), followed by stage III (12.8%), stage IV (9.9%), unstageable (7.7%) and deep tissue injury (2.4%) PI. The same trend was evident for hospital-acquired PI alone (stage I, 53.6%; stage II, 29%; stage III, 8.4%; stage IV, 3.3%; deep tissue injury, 2%; unstageable, 4%) (Li et al., 2020). Similarly, a systematic review focused on Australian and New Zealand hospitals reported an overall and hospital-acquired PI prevalence of 12.9% and 7.9%, respectively. Overall, the most commonly occurring PIs were stage I (44.8%) and stage II (42.1%), followed by stage IV (6.9%), stage III (5.2%), suspected deep tissue injury (.5%) and unstageable (.5%) (Rodgers et al., 2021). These results are congruent with those of a more recent multi-site study in the United States (VanGilder et al., 2021) and an unpublished Australian study by the authors. The former study (VanGilder et al., 2021) reported that there were more patients with stage I or II PIs than more severe injuries (hospital-acquired and present-on-admission) across over 296,014 patients in the years 2018 and 2019 (> 880 facilities in each year). The latter unpublished state-wide study (n = 15,678) found that there were greater proportions of stage I (41.6%) and II (30.8%) hospital-acquired PIs than stage III (4.9%), stage IV (0.8%), unstageable (7.1%), suspected deep tissue injury (11%) and mucosal injuries (3.7%). Notably though, both found greater proportions of severe

What Does this Paper Contribute to the wider Global Community?

- Assessment of pressure injury category affects decision-making about the use of resources, treatments and management of the injury. This study provides important information about the accuracy of pressure injury categorisation and reporting, which may be used for national and international benchmarking.
- Relatively few studies have reported accuracy of pressure injury reporting and none to date have included all pressure injury categories. Benchmark data are provided for all categories of pressure injury, including mucous membrane pressure injuries.
- Whilst moderate inter-rater agreement of pressure injury categorisation was found between reporting clinicians and nurse experts, the results indicate that pressure injury differential diagnosis and categorisation of severe injuries are inadequate, providing a focal point for future education and improvement efforts in clinical practice.

TABLE 1 Classification of pressure injury.

Pressure injury category	Description
Stage I	Non-blanchable erythema
Stage II	Partial thickness skin loss
Stage III	Full thickness skin loss
Stage IV	Full thickness tissue loss
Unstageable	Depth unknown (covered in eschar or slough)
Suspected deep tissue injury	Depth unknown
Mucous membrane	Injuries of the respiratory, gastrointestinal or genitourinary moist membranes, primarily associated with medical devices

PIs (stage III, IV and suspected deep tissue injury) in intensive care versus non-intensive care populations (although VanGilder et al. included unstageable PI in their classification of 'severe'). In the United States study, there were also more intensive care patients with a severe PI than stage I or II PIs.

Whilst these studies provide insight into variations in PI categorisation across hospitals, previous research has questioned the accuracy of categorisation and reporting in this setting. Results from several studies pre-dating the first publication (2009) of the international NPUAP/EPUAP classification system suggest that PI differential diagnosis, categorisation and/or reporting accuracy using other classification systems was variable, but generally suboptimal (Beeckman et al., 2007; Briggs, 2006; Gunningberg & Ehrenberg, 2004; Hart et al., 2006; Nixon et al., 2005). Previous studies have also focused on inter-rater reliability (e.g. agreement between two similar raters) in combination with or as opposed to accuracy (e.g. bedside clinician assessment versus a gold standard assessment). In terms of PI classification inter-rater reliability in older studies, a systematic review found that studies were heterogenous and concluded that no single classification system could be recommended, and that further well-designed research comparing systems with similar raters and samples was required (Kottner et al., 2009).

Since the widespread adoption of the international NPUAP/EPUAP classification system (NPUAP et al., 2014), more recent evidence has indicated that PI categorisation accuracy has continued to be inadequate. For example, in an analysis of data from one United States tertiary institution (n = 1499 patients), bedside nurses and clinical experts agreed on the presence or absence of a PI in 86.9% of cases, of which 95% were associated with no PI; but there were 145 differences in PI categorisation (Bruce et al., 2012). The authors also reported on a literature review across settings, in which literature pertaining to the accuracy and reliability of PI categorisation was found to be limited and results highly variable, although inaccuracies in PI categorisation were certainly evident in some (Bruce et al., 2012). Elsewhere, an audit of PI classification in a United Kingdom general hospital found that only 56% of PI photographs were correctly categorised by nurses, which rose to 65% after an intensive training package (Kelly & Isted, 2011). A prospective Australian study found that of 363 hospital-acquired PIs reported, almost 70% were inaccurately reported in terms of stage, location, presence, or origin (hospital-acquired or present-on-admission) (Barakat-Johnson et al., 2018). However, contemporary evidence of PI categorisation accuracy is limited, with studies often not including all current categories of PI.

Inaccurate reporting of PI category not only has the potential to affect benchmarking and reporting of quality standards but may incur inappropriate funding penalties. More importantly, monitoring, management, and treatment decisions may be impacted, with inappropriate resource allocation or inefficient preventative intervention implementation resulting in poor health outcomes for patients. Therefore, the aim of this study was to determine the accuracy of PI categorisation and reporting by bedside clinicians, in comparison with expert specialist nurse assessments.

2 | METHODS

2.1 | Design

A secondary analysis of hospital PI incident and validation data was undertaken. The Guidelines for Reporting Reliability and Agreement Studies (GRRAS; Kottner et al., 2011) checklist was used to guide reporting (Data S1).

2.2 | Setting

The setting was a 663-bed tertiary general hospital in south-east Queensland, Australia in which the International NPUAP/EPUAP Pressure Ulcer Classification System is used for skin PI categorisation (NPUAP et al., 2014; 2019) and mucous membrane PIs are reported as a separate category. The Waterlow score is used to assess PI risk level (Waterlow, 2005). All nurses are required to participate in the hospital's *Pressure Injury Skills Escalator* training program, which includes PI categorisation and nurse experts undertake the state-wide PI categorisation training program and are required to maintain their knowledge via regular webinars on PI and moisture-associated wound management.

As part of standard practice, all PIs (hospital-acquired and present-on-admission) are reported via the hospital's clinical incident monitoring system by bedside clinicians (usually nurses) when first identified. The reported PIs are then routinely reviewed independently by any one of a team of seven nurse experts from the hospital's *Quality Effectiveness Support Team* (QuEST) to confirm their presence, location and category. The initial incident report data and the nurse expert's review are documented in annual audit databases maintained by QuEST. Furthermore, all reportable *Hospital-Acquired Complications* (HACs), that is stage III, IV, suspected deep tissue and unstageable PIs (Australian Commission on Safety and Quality in Health Care, 2022) that are identified by

nurse experts are also confirmed by either the wound and stoma service or a podiatrist (for wounds to the ankle and distally). These reportable PIs must be investigated further in relation to risk assessment and management strategies and may incur financial penalties for the facility.

2.3 | Sample

The sample included all PIs (hospital-acquired and present-on-admission) which were reported in adults (≥18 years) between the years 2016 and 2019 that were subsequently followed up and validated by expert specialist nurses from QuEST.

2.4 | Data collection

Data pertaining to the accuracy of PI categorisation (i.e. initially reported category, location; nurse expert confirmed or corrected PI status, category, location) were extracted from the annual audit databases (2016 to 2019), and merged into a single database in Microsoft Excel™, where they were cleaned and checked with duplicates removed. Excel™ databases of the initial PI incident reports were also provided by the Coordinator Clinical Incidents, Safety and Quality Unit of the hospital for cross-checking and inclusion of demographic details (e.g. age and gender) in the study database. Data were then imported into IBM SPSS™ (version 28) for statistical analysis.

2.5 | Data analysis

Descriptive statistics were used to describe sample characteristics. Means (M) with standard deviation (SD) were used to describe central tendency of scale data. Medians (Md) and proportions were used to describe ordinal and categorical variables. Consistent with Nowicki et al. (2018), severe PIs were defined as stage III, IV or suspected deep tissue injury. For analysis, we excluded unstageable PI from this grouping as they may not always be 'severe'. Time intervals were calculated within SPSS based on dates and measured in whole days. As time intervals were not exact, central tendency is described using Md with inter-quartile range (IQR). *T*-tests were used to analyse differences in scale variables, and Fisher's exact test was used to analyse differences in proportions of categorical variables. For the purpose of analysis, the nurse expert assessments were regarded as being correct, that is the 'gold standard', with absolute agreement reported using percentage. Cohen's Kappa (K) measure of agreement was used to assess inter-rater agreement of PI category between bedside clinician assessors and nurse experts. Because the seven categories cannot be regarded as ordinal, weighted Kappa was inappropriate. Due to the importance of hospital-acquired PI for benchmarking purposes, sub-set analyses of this group were conducted. Significance was set at $p < .05$.

Approval for use of the data for this study was granted by the relevant data custodians, and ethical approval was obtained from the hospital's research ethics committee (reference HREC/2018/QPCH/48786).

3 | RESULTS

A total of 6186 clinical incident reports of PI, which were reviewed by nurse experts, were included in the analysis. The injuries were reported in 4445 separate clinical incident reports, with between 1–14 injuries included in each report. The majority of injuries (56.6%, $n = 4121/6161$) were reviewed and validated within one day of being reported via the clinical incident system (Md 1, IQR 1–2). In terms of specialty areas, the largest proportion of injuries (12.5%, $n = 773$) was reported in intensive care patients.

3.1 | Sample characteristics

The mean age of patients at the time of the clinical incident report was 75.3 years (SD 14.7, range 18–106; $n = 3932$). Just over half were males (53.3%, $n = 2371/4430$) who were younger (M 73.6, SD 14.4, $n = 2118$) than females (M 77.2, SD 14.7, $n = 1814$; $p < .001$). In most cases (81.2%, $n = 3608$), the patient's PI risk category was recorded (Waterlow, 2005). Of these, over half was at 'very high risk' of PI (57.5%, $n = 2076$), a quarter was at 'high risk' (28.2%, $n = 1016$), with the remainder 'at risk' (11.7%, $n = 423$) or 'not at risk' (2.6%, $n = 93$).

3.2 | Pressure injury characteristics

Of 6186 injuries that were reported originally, 5057 (81.7%) were validated as PIs. Of these, the most common sites were the sacrum (18.7%, $n = 948$), buttocks (16.8%, $n = 849$), heel (13.2%, $n = 669$) and coccyx (12.2%, $n = 616$) (see Table 2). Based on their validated category, most PIs were stage I (40.8%, $n = 2061$) or stage II (33.0%, $n = 1668$), 15.2% ($n = 768$) were severe PIs (stage III, IV or suspected deep tissue injury), and 5.2% ($n = 265$) were mucosal PIs. Just under half of all validated PIs were hospital-acquired (45.9%, $n = 2321$) (see Table 2). There were statistically significant greater proportions of stages I-IV and unstageable PIs present-on-admission, and statistically significant greater proportions of hospital-acquired suspected deep tissue injuries and mucosal PIs (see Table 2).

3.3 | Validated pressure injury category

In the study hospital, there are five clinical programs (directorates). Whilst the number of initially reported PIs varied between programs, overall, the proportions that were validated as being correct in each program were similar (see Table 3). A greater proportion of hospital-acquired PIs (70.0%) were reported correctly compared to

TABLE 2 Validated pressure injuries by category.

Validated pressure injury category	Number of pressure injuries (%)			Significance p[a]
	Present-on-admission	Hospital-acquired	Total	
Stage I	1162 (56.4) (42.5)	899 (43.6) (38.7)	2061 (100) (40.8)	.008
Stage II	939 (56.3) (34.3)	729 (43.7) (31.4)	1668 (100) (33.0)	.029
Stage III	135 (90.6) (4.9)	14 (9.4) (0.6)	149 (100) (2.9)	<.001
Stage IV	20 (100) (0.7)	0 (0) (0)	20 (100) (0.4)	<.001
Suspected deep tissue injury	226 (37.7) (8.3)	373 (62.3) (16.1)	599 (100) (11.8)	<.001
Unstageable	231 (78.3) (8.4)	64 (21.7) (2.8)	295 (100) (5.8)	<.001
Mucosal	23 (8.7) (0.8)	242 (91.3) (10.4)	265 (100) (5.2)	<.001
Total	2736 (54.1) (100)	2321 (45.9) (100)	5057 (100) (100)	

[a]Fisher's exact test.

TABLE 3 Initially reported as pressure injuries by clinical program.

Clinical program	Total reported n (%)			Proportion validated % (n)			
	Overall	Present-on-admission	Hospital-acquired	Overall	Present-on-admission	Hospital-acquired	significance p[b]
Critical Care	803 (13.0)	88 (1.4)	715 (11.6)	67.9 (545)	60.2 (53)	68.8 (492)	.153
Cardiothoracic	884 (14.4)	311 (5.0)	573 (9.3)	70.0 (618)	69.5 (216)	70.3 (403)	.759
Hospital-wide Services[a]	2082 (33.8)	1963 (31.9)	119 (1.9)	64.6 (1345)	63.9 (1254)	76.4 (91)	.006
Internal Medicine	1656 (26.9)	763 (12.4)	893 (14.5)	68.9 (1141)	66.7 (509)	70.9 (633)	.070
Surgery	734 (11.9)	271 (4.4)	463 (7.5)	68.3 (501)	68.3 (185)	68.3 (316)	1
Total	6159 (100)	3396 (55.1)	2763 (44.9)	67.4 (4150)	65.3 (2217)	70.0 (1935)	<.001

[a]Mainly the emergency department.

[b]Fisher's exact test, missing $n = 27$.

present-on-admission PIs (65.3%; $p < .001$) (Table 3). However, when individual programs were compared, the difference was only significant for the Hospital-wide Services program ($p = .006$), nearly all of which were reported in the emergency department.

A relatively large proportion (18.3%, $n = 1129$) of all injuries that were reported initially as PIs, were found to be non-PIs (i.e. wounds of other aetiologies) when validated (see Table 4). Of these, most were reported originally as either stage II (41.2%, n = 465) or stage I PIs (30.5%, n = 344), and 13.4% (n = 151) were categorised initially as unstageable (Table 4). In most of these cases (65.8%, $n = 743$), a brief description of the injury or wound was recorded by nurse experts. The largest proportions were described as trauma injuries (20.7%, $n = 154$), incontinence-associated dermatitis (14.0%, $n = 104$), moisture lesions (7.1%, $n = 53$), skin lesions (6.7%, $n = 50$), skin tears (5.5%, $n = 41$) or chronic ulcers (4.0%, $n = 30$). In 39 cases (5.2%), the skin was described as 'normal'.

The proportions of PI in each category reported originally compared to those validated in each category are shown in Table 4. Overall, a third (32.7%, $n = 2023$) of all injuries reported initially as PIs were not categorised correctly. Excluding injuries later validated as non-PIs ($n = 1129$), the majority of validated PIs were reported correctly initially (82.3%, $n = 4163/5057$). Additionally, in all categories, most were reported correctly initially (range 52.5–93.6%). See Table 2.

The majority of injuries reported initially as stage I, stage II, suspected deep tissue injury and mucosal PI were validated (75.7%, 65.5%, 69.8%, and 76.3%, respectively), whereas only half of those reported initially as stage III or stage IV were correct (49.2% and 50.0%, respectively) and less than a third (31.6%) of those reported initially as unstageable PIs were correct (Table 4). Overall, only 63.6% ($n = 471/740$) of injuries reported initially as severe PIs (stage III, stage IV and suspected deep tissue injury) were validated.

TABLE 4 Reported pressure injury by validated pressure injury category.

Initially reported pressure injury category	Initially reported pressure injury: proportion correct % (*n*/*N*)	Validated PI category *n* (%)								
		Non-pressure injury	Stage I	Stage II	Stage III	Stage IV	Suspected deep tissue injury	Unstage-able	Mucosal	Total *n* (%)
Stage I	75.7 (1930/2550)	344 (13.5) (30.5)	1930 (75.7) (93.6)	177 (6.9) (10.6)	2 (0.1) (1.3)	0 (0) (0)	73 (2.9) (12.2)	10 (0.4) (3.4)	14 (0.5) (5.3)	2550 (100) (41.2)
Stage II	65.5 (1394/2127)	465 (21.9) (41.2)	83 (3.9) (4.0)	1394 (65.5) (83.6)	43 (2.0) (28.9)	1 (0.0) (5.0)	45 (2.1) (7.5)	31 (1.5) (11.7)	31 (1.5) (11.7)	2127 (100) (34.4)
Stage III	49.2 (95/193)	30 (15.5) (2.7)	7 (3.6) (0.3)	23 (11.9) (1.4)	95 (49.2) (63.8)	2 (1.0) (10.0)	3 (1.6) (0.5)	32 (16.6) (10.8)	1 (0.5) (0.4)	193 (100) (3.1)
Stage IV	50.0 (15/30)	3 (10.0) (0.3)	1 (3.3) (0.0)	1 (3.3) (0.1)	0 (0) (0)	15 (50.0) (75.0)	0 (0) (0)	10 (33.3) (3.4)	0 (0) (0)	30 (100) (0.5)
Suspected deep tissue injury	69.8 (361/517)	100 (19.3) (8.9)	11 (2.1) (0.5)	18 (3.5) (1.1)	3 (0.6) (2.0)	0 (0) (0)	361 (69.8) (60.3)	22 (4.3) (7.5)	2 (0.4) (0.8)	517 (100) (8.4)
Unstageable	31.6 (155/490)	151 (30.8) (13.4)	24 (4.9) (1.2)	40 (8.2) (2.4)	5 (1.0) (3.4)	2 (0.4) (10.0)	109 (22.2) (18.2)	155 (31.6) (52.5)	4 (0.8) (1.5)	490 (100) (7.9)
Mucosal	76.3 (213/279)	36 (12.9) (3.2)	5 (1.8) (0.2)	15 (5.4) (0.9)	1 (0.4) (0.7)	0 (0) (0)	8 (2.9) (1.3)	1 (0.4) (0.3)	213 (76.3) (80.4)	279 (100) (4.5)
Total (*n*/*N*)	67.3 (4163/6186)	1129 (18.3) (100)	2061 (33.3) (100)	1668 (27.0) (100)	149 (2.4) (100)	20 (0.3) (100)	599 (9.7) (100)	295 (4.8) (100)	265 (4.3) (100)	6186 (100) (100)
Validated pressure injuries: proportion initially reported correctly % (*n*/*N*)		0 (0/1129)	93.6 (1930/2061)	83.6 (1394/1668)	63.8 (95/149)	75.0 (15/20)	60.3 (361/599)	52.5 (155/295)	80.4 (213/265)	67.3 (4163/6186)

Of those initially reported incorrectly as stage III PI ($n = 98$), most were validated as unstageable PIs (32.7%, $n = 32$) or non-PIs (30.6%, $n = 30$), whereas the majority of those reported incorrectly as stage IV PI ($n = 15$) were mostly validated as unstageable (66.7, $n = 10$), and the majority of those reported incorrectly as suspected deep tissue injury ($n = 156$), were mostly validated as non-PIs (64.1%, $n = 100$) (Table 4). Of the 1129 injuries or wounds that were validated as non-PIs, most were reported initially as either stage II (41.2%, $n = 465$) or stage I (30.5%, $n = 344$) PIs.

Although only a relatively small proportion (4.5%, $n = 279$) of injuries overall were reported originally as mucosal PIs, three quarters (76.3%, $n = 213$) were validated. The majority of originally reported mucosal PIs (70.0%, $n = 195/279$) occurred in intensive care patients, of which 84.1% ($n = 164$) were validated whereas only 58.3% ($n = 49/84$) were reported correctly in non-intensive care patients.

When only injuries recorded originally as hospital-acquired PIs were compared to validated hospital-acquired PIs there was a slightly different pattern (see Table 5). Although significantly fewer stage III ($n = 17$) and unstageable ($n = 168$) hospital-acquired PIs were reported initially, the proportions that were reported correctly (35.3% and 19.0%, respectively) were considerably smaller compared to the overall values. Furthermore, no stage IV hospital-acquired PIs were reported initially, and none were identified from any other initially reported category when reviewed and validated.

A high proportion (84.9%) of validated hospital-acquired mucosal PIs was initially categorised correctly (see Table 5). Most were reported in intensive care patients (78.0%, $n = 181/232$), of which a high proportion (86.7%, $n = 157/181$) was initially reported correctly, compared to 78.4% ($n = 40/51$) in non-intensive care patients.

3.3.1 | Agreement

Of 6186 injuries that were reported originally as PIs, the PI category was reported correctly in two thirds (67.3%, $n = 4163$), with an overall moderate level of agreement by category ($K = .567$, $p < .001$). The level of agreement was similar for injuries reviewed within one day ($n = 4121$, $K = .560$, $p < .001$) compared to those reviewed more than one day later ($n = 2040$, $K = .579$, $p < .001$).

Of 3409 injuries that were recorded as being present-on-admission PIs, 65.3% ($n = 2225$) were initially reported correctly, and the category level of agreement was moderate ($K = .536$, $p < .001$). Of 2771 injuries recorded originally as hospital-acquired PIs, 69.9% ($n = 2771$) were initially reported correctly, with a moderate category level of agreement ($K = .603$, $p < .001$).

Pressure injury category agreement was similar between 2016 and 2018 but was somewhat better in 2019. This pattern was similar when present-on-admission and hospital-acquired injuries were analysed separately (see Table 6). If injuries validated as non-PIs are excluded, greater proportions of both present-on-admission and hospital-acquired PIs were validated correctly (80.3%, $n = 1745/2173$ and 82.9%, $n = 1680/2027$, respectively) (see Table 7).

4 | DISCUSSION

There are relatively few studies available that have analysed the reporting accuracy of PI category assessment, although several have analysed inter-rater reliability. Furthermore, there are none that have investigated PI reporting accuracy that have included all seven categories. To date, to the authors' knowledge, this is the largest study available that has specifically investigated PI category reporting accuracy across all categories. As such, it provides important benchmarking information for other facilities nationally and internationally, as well as indicating areas of educational need. The main finding of this study is that around a third of all injuries originally assessed and reported as PIs were found to have been assessed incorrectly when reviewed by nurse experts. Importantly, over half of the injuries that were reported incorrectly were found to be non-PIs on review. Of further significance is that only half (50.8%, $n = 626/1230$) of the injuries reported initially as stage III, IV, suspected deep tissue or unstageable PIs were assessed correctly. Of these, 482 injuries were reported initially as hospital-acquired PIs. Had these not been reviewed and corrected, 203 (42%) injuries would have been reported incorrectly as *Hospital-Acquired Complications* (Australian Commission on Safety and Quality in Health Care, 2022) and may have resulted in financial penalties for the facility.

A considerable proportion of injuries initially reported as unstageable PIs were found to be incorrect when reviewed. In the main, these were later found to be either suspected deep tissue injuries or non-PIs. Of particular concern is that only 19% of injuries reported initially as unstageable hospital-acquired PIs were correct. This finding may imply that some bedside clinicians were unsure of PI categories, and when in doubt may have defaulted to 'unstageable', indicating that further education may be warranted in this area. This is confirmed by the fact that only 50% of the 64 validated unstageable hospital-acquired PIs were categorised correctly initially. Furthermore, whilst the results indicate that bedside clinicians are relatively good at assessing stage I, II, suspected deep tissue injury and mucosal PIs, their assessments of stage III and IV PIs, although fewer in number, were significantly less accurate.

It is encouraging to observe that mucosal PIs, the most recently introduced category, were reported correctly in the majority of cases. Most mucosal PIs were found in intensive care patients, although there was a high level of reporting accuracy for both intensive care and non-intensive care patients. However, the reporting accuracy of present-on-admission mucosal PIs in non-intensive care patients was lower, which may be related to nurses having less knowledge of the patient's wound history prior to hospital admission.

Considering that nearly one in five injuries that were reported initially as PIs were found to be non-PIs on review signifies an area of clinical concern, which suggests that clinicians' differential diagnosis of PI is poor. Whilst only a brief description of non-PIs was recorded in only two thirds of cases, the results indicate that trauma injuries, incontinence-associated dermatitis and moisture lesions account for main proportion of incorrect diagnoses, providing some good evidence for clinical educators to target, to help improve PI

TABLE 5 Reported pressure injury by validated hospital-acquired pressure injury category.

Initially reported pressure injury category	Initially reported pressure injury: proportion correct % (*n*/*N*)	Validated pressure injury category *n* (%)								
		Non-pressure injury	Stage I	Stage II	Stage III	Stage IV	Suspected deep tissue injury	Unstage-able	Mucosal	Total *n* (%)[a]
Stage I	75.5 (850/1126)	132 (11.7) (29.3)	850 (75.5) (94.5)	85 (7.5) (11.7)	0 (0) (0)	0 (0) (0)	47 (4.2) (12.6)	2 (0.2) (3.1)	10 (0.9) (4.1)	1126 (100) (40.6)
Stage II	65.7 (612/931)	208 (22.3) (46.2)	33 (3.5) (3.7)	612 (65.7) (84.0)	5 (0.5) (35.7)	0 (0) (0)	23 (2.5) (6.2)	21 (2.3) (32.8)	29 (3.1) (12.0)	931 (100) (33.6)
Stage III	35.3 (6/17)	3 (17.6) (0.7)	1 (5.9) (0.1)	5 (29.4) (0.7)	6 (35.3) (42.9)	0 (0) (0)	0 (0) (0)	1 (5.9) (1.6)	1 (5.9) (0.4)	17 (100) (0.6)
Stage IV	0 (0/0)	0 (0) (0)	0 (0) (0)	0 (0) (0)	0 (0) (0)	0 (0) (0)	0 (0) (0)	0 (0) (0)	0 (0) (0)	0 (0) (0)
Suspected deep tissue injury	81.1 (241/297)	33 (11.1) (7.3)	6 (2.0) (0.7)	7 (2.4) (1.0)	1 (0.3) (7.1)	0 (0) (0)	241 (81.1) (64.6)	7 (2.4) (10.9)	2 (0.7) (0.8)	297 (100) (10.7)
Unstageable	19.0 (32/168)	57 (33.9) (12.7)	8 (4.8) (0.9)	12 (7.1) (1.6)	1 (0.6) (7.1)	0 (0) (0)	55 (32.7) (14.7)	32 (19.0) (50.0)	3 (1.8) (1.2)	168 (100) (6.1)
Mucosal	84.9 (197/232)	17 (7.3) (3.8)	1 (0.4) (0.1)	8 (3.4) (1.1)	1 (0.4) (7.1)	0 (0) (0)	7 (3.0) (1.9)	1 (0.4) (1.6)	197 (84.9) (81.4)	232 (100) (8.4)
Total (*n*/*N*)	69.9 (1938/2771)	450 (16.2) (100)	899 (32.4) (100)	729 (26.3) (100)	14 (0.5) (100)	0 (0) (0)	373 (13.5) (100)	64 (2.3) (100)	242 (8.7) (100)	2771 (100) (100)
Validated pressure injuries: proportion initially reported correctly % (*n*/*N*)		0 (0/450)	94.5 (850/899)	84.0 (612/729)	42.9 (6/14)	0 (0/0)	64.6 (241/373)	50.0 (32/64)	81.4 (197/242)	69.9 (1938/2771)

[a]Missing $n = 6$.

TABLE 6 Kappa measure of agreement across years: all injuries.

Originally reported as pressure injuries	Kappa (*n*)				
	2016	2017	2018	2019	Overall
Present-on-admission[a]	.543 (556)	.463 (793)	.525 (1081)	.604 (979)	.536 (3409)
Hospital-acquired[a]	.592 (619)	.575 (736)	.591 (727)	.648 (689)	.603 (2771)
All	.570 (1176)	.517 (1530)	.552 (1812)	.625 (1668)	.567 (6186)

Note: All Kappa values significant $p < .001$.

[a]missing $n = 6$.

TABLE 7 Kappa measure of agreement across years: validated pressure injuries only.

Validated as pressure injuries	Kappa (*n*)				
	2016	2017	2018	2019	Overall
Present-on-admission	.705 (460)	.648 (618)	.738 (846)	.781 (812)	.713 (2173)
Hospital-acquired	.739 (526)	.740 (613)	.777 (595)	.802 (587)	.757 (2027)
All	.725 (986)	.695 (1231)	.756 (1441)	.793 (1399)	.746 (5057)

Note: All Kappa values significant $p < .001$.

diagnosis. In an Australian study where, similar to our own, PIs that were reported via the hospital's clinical incident monitoring system were followed up, it was found that 69.7% ($n = 253/363$) of all injuries reported as hospital-acquired PIs were reported incorrectly (Barakat-Johnson et al., 2018). Significantly, nearly half of the sample (48.5%) was found to have skin conditions that were incorrectly diagnosed and reported as PIs. Of these, moisture-associated skin damage accounted for around a third. The researchers also conducted semi-structured interviews with nurses, who indicated that they felt the need to report all skin conditions, even if they were not sure it was a PI, and even where they felt it was not a PI but had no other reporting avenue. We recommend that further, more specific data should be collected to help identify the main areas of misdiagnosis, with the use of standardised wound or injury descriptions.

In terms of PI categorisation accuracy, our results indicate overall moderate agreement between bedside clinicians and nurse experts. The proportions of correct assessments by category, shown in the results and described above, indicate where key improvements may be made. In the other Australian study by Barakat-Johnson et al. (2018), although only stage I-IV hospital-acquired PIs were categorised, overall PI category was reported correctly most of the time (71.5%, $n = 108/151$), with a moderate level of agreement (K =.59); similar to that found in our study. Although only ten stage III or IV hospital-acquired PIs were validated in total, 40% was reported incorrectly. Elsewhere, in a clinical audit across 66 Welsh hospitals (Clark et al., 2017), visual verification of PI category by two independent experienced nurses compared to ward staff assessments ($n = 593$) revealed that 20.9% was classified incorrectly, although PI categories were not identified separately in the study report, and mucosal PIs were not included. Furthermore, the audit did not aim to examine accuracy directly, with the authors noting that comparison of accuracy of PI ward reports was not possible due to the relatively large proportion of patients for whom no direct examination of the skin was able to be undertaken.

Other studies that have examined reporting accuracy of PI category have used photographs to compare accuracy. Similar results to ours were found in a recent Spanish study (Rodriguez-Calero et al., 2021) in which registered nurses and third year nursing students were asked to categorise the PI category of wounds presented in 14 photographs, in which the wound categories had previously been agreed by a panel of experts. Overall agreement with expert consensus was 62.8% ($n = 2760$), with registered nurses performing only slightly better (63.9%) than nursing students (60.5%). In this study, two photographs were of wounds classified as unstageable or suspected deep tissue injury. Overall agreement was lowest for these wounds (47.9%); however, the photographs did not differentiate between the unstageable and suspected deep tissue injury categories. Nevertheless, the results indicate poor assessment accuracy of unstageable PIs, similarly to that found in our study.

An earlier United Kingdom study also used photographs to assess PI categorisation (Kelly & Isted, 2011). In their baseline study, conducted in 2010, nurses were asked to identify the PI category of three photographs from a pool of five. Overall accuracy was low (56%) and correct classification of unstageable PI was very low (6%, $n = 93$), with a moderate overall agreement (K =.48). Following implementation of an intensive training package, overall accuracy improved to 62% with moderate agreement (K =.50) when nurses categorised three of a potential ten photographs; however, the correct classification of unstageable PIs remained low (17%). In another study conducted around the same time in the United States (Bergquist-Beringer et al., 2011), PIs were categorised across 31 hospitals by raters ($n = 180$; including skin care experts and staff who usually undertook PI survey patient examinations) via direct observation. The raters ($n = 162/180$) then subsequently completed an Internet-based test using 17 PI photographs. Accuracy of

PI categorisation was compared to skin care experts' assessments. Moderate agreement of PI category overall was reported between raters' direct observations (K = .60), including stage I-IV and unstageable PIs. Overall agreement of raters' categorisation using the photographs was better (K = .69) but was substantially better in the sub-set who analysed photographs that included a short description of the wound (K = .81). At the time of both of these studies, *unstageable* PI was a relatively new category, and nurses' lack of familiarity may partially explain the results.

A later Korean study (Lee et al., 2016), conducted in 2013, compared nurses' (n = 407) classifications of six PI categories and incontinence-associated dermatitis, using 21 photographs. Assessment accuracy was compared before and after an education program (50-min lecture plus case studies), demonstrating significant overall improvements across all categories (51.3% versus 75.7%). However, it is unclear when the post-test assessment was conducted and whether the increased accuracy of reporting was transferred and sustained into clinical practice. In this study, both suspected deep tissue injury and unstageable PIs were assessed poorly before the education program (14.0% and 25.7% correct, respectively) although both improved subsequently (44.2% and 68.8%, respectively). Notably, only just over half of stage III PIs (55.3%) were reported correctly after the education program, indicating an area of concern, similar to that found in our study. In a Colombian study (Cortés et al., 2018), 97 photographs of PIs were used to compare the PI category between three nurse experts and the stage recorded in the nursing notes. Only stage I and II PIs were identified and compared, with moderate to good agreement reported (K = .47–.62). However, agreement by individual stage was not reported.

Overall, most studies, including our own, demonstrate moderate reporting accuracy of PI category, with evidence suggesting that more severe PIs and unstageable PIs are identified less well. The reasons for this are unclear, although 61.6% of health professionals (n = 88) who participated in a survey at a United States national wound care meeting felt that the current NPUAP/NPIAP PI classification system (Edsberg et al., 2016 United States update of NPUAP et al., 2014) was not easily reproducible, whilst most (58.0%) agreed it was easy to use (Stefanopoulos et al., 2021). Although participants in this study included physicians, nurse practitioners and allied health professionals, it was not clear how many were nurses. Since invariably it is nurses that use the PI classification system, they are more like to be familiar with its use, whereas this may not be the case for physicians and allied health professionals. This may have led to some bias in the results. Qualitative evidence supports the view that PI categorisation accuracy is related to knowledge levels (Gaspar et al., 2021), and survey studies have found that PI knowledge, including that pertaining to PI classification, is often suboptimal (Cukljek et al., 2022; Fulbrook et al., 2019). There is also some evidence to indicate that nurses' accuracy of PI category reporting improves after educational intervention (Kelly & Isted, 2011; Lee et al., 2016; Okhovati et al., 2019) or with the use of clinical decision support systems or tools (Alvey et al., 2012; Young et al., 2011). However, further research is needed to establish the sustainability of PI categorisation improvements within clinical practice.

4.1 | Limitations

In this study, the assumption was made that all PI category assessments made by the nurse experts were correct. Furthermore, nurse experts may have been influenced by initial assessments, as they were not blinded to them, which may increase Kappa values (Thompson & Walter, 1988). In some cases, documentation of the PI category may have been reported incorrectly via the clinical incident system due to human error. The potential for errors may have been increased when multiple PIs were reported via a single incident report. There is potential for the PI category to change between the time it was reported via the clinical incident system to the time it was reviewed, although this was not apparent in our analysis. Furthermore, estimates of time-to-review are crude, as they are based on whole day measures. However, when the PI was reviewed, a substantial number were reported to have resolved, with nurse experts making the assumption that the initial categorisation was correct. This emphasises the importance of the need for a validation process to be implemented on the ward at the time the PI is first identified. Finally, it is important to acknowledge that our results are historical and may not reflect current practice.

5 | CONCLUSION

This study provides important insight into the accuracy of PI categorisation and reporting across all categories of PI as recognised by a widely used international classification system. Whilst a moderate reporting accuracy of PI category was found and the results indicate that bedside clinicians are relatively good at assessing stage I, II, suspected deep tissue injury and mucosal PIs, assessments of stage III, IV and particularly unstageable PIs were significantly less accurate. The incorrect assessment of severe hospital-acquired PIs may have implications for institutional financial penalties. Furthermore, over half of the injuries that were reported incorrectly were found to be non-PIs, suggesting that clinicians' differential diagnosis of PI is poor. Had these injuries not been validated by experts, PI incidence would have been incorrectly inflated by around 25%, signalling the institutional importance of effective validation processes.

6 | RELEVANCE TO CLINICAL PRACTICE

The results of this study may be used for national and international benchmarking and emphasise the clinical importance of validation by expert nurses of all injuries reported as PIs. The results also indicate a need to focus education efforts on improvement of PI alternate diagnoses and the accurate categorisation of severe and unstageable PIs.

AUTHOR CONTRIBUTIONS

Study conception and design; acquisition, analysis and interpretation of data; manuscript drafting; critical revisions for important intellectual content; manuscript finalisation and approval for submission: both authors.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

DATA AVAILABILITY STATEMENT

Data available on reasonable request from the authors.

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REFERENCES

Alvey, B., Henne, N., & Heard, H. (2012). Improving accuracy of pressure ulcer staging and documentation using a computerized clinical decision support system. *Journal of Wound, Ostomy, and Continence Nursing*, *39*(6), 607–612. https://doi.org/10.1097/WON.0b013e31826a4b5c

Australian Commission on Safety and Quality in Health Care. (2022). *Hospital-acquired complications (HACs)*. [Online]. Available at https://www.safetyandquality.gov.au/our-work/indicators/hospital-acquired-complications

Barakat-Johnson, M., Lai, M., Barnett, C., Wand, T., Wolak, D. L., Chan, C., Leong, T., & White, K. (2018). Hospital-acquired pressure injuries: Are they accurately reported? A prospective descriptive study in a large tertiary hospital in Australia. *Journal of Tissue Viability*, *27*(4), 203–210. https://doi.org/10.1016/j.jtv.2018.07.003

Beeckman, D., Schoonhoven, L., Fletcher, J., Furtago, K., Gunningberg, L., Heyman, H., Lindholm, C., Paquay, L., Verdú, J., & Defloor, T. (2007). EPUAP classification system for pressure ulcers: European reliability study. *Journal of Advanced Nursing*, *60*(6), 682–691. https://doi.org/10.1111/j.1365-2648.2007.04474.x

Bergquist-Beringer, S., Gajewski, B., & Klaus, S. (2011). The reliability of the national database of nursing quality indicators pressure ulcer indicator. A triangulation approach. *Journal of Nursing Care Quality*, *26*(4), 292–301. https://doi.org/10.1097/NCQ.0b013e3182169452

Briggs, S. (2006). How accurate are RGNs in grading pressure ulcers? *British Journal of Nursing*, *15*(22), 1230–1234. https://doi.org/10.12968/bjon.2006.15.22.22561

Bruce, T. A., Shever, L. L., Tschannen, D., & Gombert, J. (2012). Reliability of pressure ulcer staging: A review of literature and 1 institution's strategy. *Critical Care Nursing Quarterly*, *35*(1), 85–101. https://doi.org/10.1097/CNQ.0B013E31823B1F22

Burston , A. , Miles , S. J., & Fulbrook, P. (2022). Patient and carer experience of living with a pressure injury: A systematic review and meta-synthesis. *Journal of Clinical Nursing*. https://doi.org/10.1111/jocn16431. Epub ahead of print.

Centres for Medicare & Medicaid Services. (2022). *Hospital-Acquired Conditions*. [Online]. Available at https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/Hospital-Acquired_Conditions

Clark, M., Semple, M. K., Ivins, N., Mahoney, K., & Harding, K. (2017). National audit of pressure ulcers and incontinence-associated dermatitis in hospitals across Wales: A cross-sectional study. *BMJ Open*, *7*, e015616. https://doi.org/10.1136/bmjopen-2016-015616

Cortés, O. L., Alvarado, P. A., Rojas, Y. A., Salazar, L. D., Acuña, X., & Esparza, M. (2018). Digital photography: A tool for nursing on the assessment of pressure lesions. *Investigación y Educación en Enfermería*, *36*(2), e07. https://doi.org/10.17533/udea.iee.v36n2e07

Cukljek, S., Rezic, S., Ficko, S. L., Hosnjak, A. M., Smrekar, M., & Ljubas, A. (2022). Croatian nurses' and nursing students' knowledge about pressure injury prevention. *Journal of Tissue Viability*, *31*(3), 453–458. https://doi.org/10.1016/j.jtv.2022.04.008

Edsberg, L. E., Black, J. M., Goldberg, M., McNichol, L., Moore, L., & Sieggreen, M. (2016). Revised national pressure ulcer advisory panel pressure injury staging system: Revised pressure injury staging system. *Journal of Wound, Ostomy, and Continence Nursing*, *43*(6), 585–597. https://doi.org/10.1097/WON.0000000000000281

European Pressure Ulcer Advisory Panel [EPUAP], National Pressure Injury Advisory Panel [NPIAP] & Pan Pacific Pressure Injury Alliance [PPPIA]. (2019). *Prevention and treatment of pressure ulcers/injuries: Clinical practice guideline. The international guideline*. European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel & Pan Pacific Pressure Injury Alliance.

Fernando-Canavan, L., Gust, A., Hsueh, A., Tran-Duy, A., Kirk, M., Brooks, P., & Knight, J. (2021). Measuring the economic impact of hospital-acquired complications on an acute health service. *Australian Health Review*, *45*(2), 135–142. https://doi.org/10.1071/AH20126

Fulbrook, P., Lawrence, P., & Miles, S. (2019). Australian nurses' knowledge of pressure injury prevention and management: A cross-sectional survey. *Journal of Wound, Ostomy, and Continence Nursing*, *46*(2), 106–112. https://doi.org/10.1097/WON.0000000000000508

Gaspar, S., Botelho Guedes, F., Vitoriano Budri, A. M., Ferreira, C., & Gaspar de Matos, M. (2021). Hospital-acquired pressure ulcers prevention: What is needed for patient safety? The perceptions of nurse stakeholders. *Scandinavian Journal of Caring Sciences*, *36*(4), 978–987. https://doi.org/10.1111/scs.12995

Hart, S., Bergquist, S., Gajewski, B., & Dunton, N. (2006). Reliability testing of the national database of nursing quality indicators pressure

ulcer indicator. *Journal of Nursing Care Quality*, *21*(3), 256–265. https://doi.org/10.1097/00001786-200607000-00011

Independent Health and Aged Care Pricing Authority. (2022). *Safety and Quality*. [Online]. Available at https://www.ihacpa.gov.au/health-care/pricing/safety-and-quality

Jackson, D., Hutchinson, M., Barnason, S., Li, W., Mannix, J., Neville, S., Piper, D., Power, T., Smith, G. D., & Usher, K. (2016). Towards international consensus on patient harm: Perspectives on pressure injury policy. *Journal of Nursing Management*, *24*(7), 902–914. https://doi.org/10.1111/jonm.12396

Kelly, J., & Isted, M. (2011). Assessing nurses' ability to classify pressure ulcers correctly. *Nursing Standard*, *26*(7), 62–71. https://doi.org/10.7748/ns2011.10.26.7.62.c8762

Kottner, J., Audigé, L., Brorson, S., Donner, A., Gajeweski, B. J., Hróbjartsson, A., Roberts, C., Shoukri, M., & Streiner, D. L. (2011). Guidelines for reporting reliability and agreement studies (GRRAS) were proposed. *Journal of Clinical Epidemiology*, *64*(1), 96–106.

Kottner, J., Cuddigan, J., Carville, K., Balzer, K., Berlowitz, D., Law, S., Litchford, M., Mitchell, P., Moore, Z., Pittman, J., Sigaudo-Roussel, D., Yee, C. Y., & Haesler, E. (2020). Pressure ulcer/injury classification today: An international perspective. *Journal of Tissue Viability*, *29*(3), 197–203. https://doi.org/10.1016/j.jtv.2020.04.003

Kottner, J., Raeder, K., Halfens, R., & Dassen, T. (2009). A systematic review of interrater reliability of pressure ulcer classification systems. *Journal of Clinical Nursing*, *18*(3), 315–336. https://doi.org/10.1111/j.1365-2702.2008.02569.x

Lee, Y. J., Kim, J. Y., & Korean Association of Wound Ostomy Continence Nurses. (2016). Effects of pressure ulcer classification system education on knowledge and visual differential diagnostic ability of pressure ulcer classification and incontinence-associated dermatitis for clinical nurses in Korea. *International Wound Journal*, *31*(S1), 26–32. https://doi.org/10.1111/iwj.12546

Li, Z., Lin, F., Thalib, L., & Chaboyer, W. (2020). Global prevalence and incidence of pressure injuries in hospitalised adult patients: A systematic review and meta-analysis. *International Journal of Nursing Studies*, *105*, 103546. https://doi.org/10.1016/j.ijnurstu.2020.103546

National Pressure Ulcer Advisory Panel [NPUAP] & European Pressure Ulcer Advisory Panel [EPUAP]. (2009). *Prevention and treatment of pressure ulcers: Clinical practice guideline*. National Pressure Ulcer Advisory Panel.

National Pressure Ulcer Advisory Panel [NPUAP], European Pressure Ulcer Advisory Panel [EPUAP] & Pan Pacific Pressure Injury Alliance [PPPIA]. (2014). *Prevention and treatment of pressure ulcers: Clinical practice guideline*. National Pressure Ulcer Advisory Panel.

Nghiem, S., Campbell, J., Walker, R. M., Byrnes, J., & Chaboyer, W. (2022). Pressure injuries in Australian public hospitals: A cost of illness study. *International Journal of Nursing Studies*, *130*, 104191. https://doi.org/10.1016/j.ijnurstu.2022.104191

Nixon, J., Thorpe, H., Barrow, H., Phillips, A., Nelson, E. A., Mason, S. A., & Cullum, N. (2005). Reliability of pressure ulcer classification and diagnosis. *Journal of Advanced Nursing*, *50*(6), 613–623. https://doi.org/10.1111/j.1365-2648.2005.03439.x

Nowicki, J., Mullany, D., Spooner, A., Nowicki, T. A., Mckay, P. M., Corley, A., Fulbrook, P., & Fraser, J. F. (2018). Are pressure injuries related to skin failure in critically ill patients? *Australian Critical Care*, *31*(5), 257–263. https://doi.org/10.1016/j.aucc.2017.07.004

Okhovati, S., Esmaeili, M., & Esmaeil, S. (2019). Effect of intensive care unit nurses' empowerment program on ability in visual differential diagnosis of pressure ulcer classification. *Critical Care Nursing Quarterly*, *42*(1), 89–95. https://doi.org/10.1097/CNQ.0000000000000242

Padula, W. V., Black, J., Davidson, P., Kang, S. Y., & Pronovost, P. J. (2020). Adverse effects of the medicare PSI-90 hospital penalty system on revenue-neutral hospital-acquired conditions. *Journal of Patient Safety*, *16*(2), e97–e102. https://doi.org/10.1097/PTS.0000000000000517

Rodgers, K., Sim, J., & Clifton, R. (2021). Systematic review of pressure injury prevalence in Australian and New Zealand hospitals. *Collegian*, *28*(3), 310–323. https://doi.org/10.1016/j.colegn.2020.08.012

Rodriguez-Calero, M. A., Fullana-Matas, A., & Miró-Bonet, R. (2021). Classification of pressure injury stages and skin damage photographs by RNs and nursing students in Spain. *Journal of Wound, Ostomy, and Continence Nursing*, *48*(5), 403–409. https://doi.org/10.1097/WON.0000000000000803

Stefanopoulos, S., Qui, Q., Alshaibani, K., Bauer, K., Ahmed, A., Nazzal, M., & Osman, M. F. (2021). Evaluation of current pressure ulcer staging. *The American Surgeon*. https://doi.org/10.1177/00031348211038574. Epub ahead of print.

Thompson, W. D., & Walter, S. D. (1988). A reappraisal of the kappa coefficient. *Journal of Clinical Epidemiology*, *41*(10), 949–958. https://doi.org/10.1016/0895-4356(88)90031-5

VanGilder, C. A., Cox, J., Edsberg, L. E., & Koloms, K. (2021). Pressure injury prevalence in acute care hospitals with unit-specific analysis: Results from the international pressure ulcer prevalence (IPUP) survey database. *Journal of Wound, Ostomy, and Continence Nursing*, *48*(6), 492–503. https://doi.org/10.1097/WON.0000000000000817

Waterlow, J. (2005). *Waterlow score card*. http://www.judy-waterlow.co.uk/the-waterlow-score-card.htm

Young, D. L., Estocado, N., Landers, M., & Black, J. (2011). A pilot study providing evidence for the validity of a new tool to improve assignment of national pressure ulcer advisory panel stage to pressure ulcers. *Advances in Skin and Wound Care*, *24*(4), 168–175. https://doi.org/10.1097/01.ASW.0000396304.90710.EA

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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