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Incidence of hospital-acquired pressure injuries and predictors of severity in a paediatric hospital

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Abstract

Background: Hospital-acquired pressure injuries (HAPIs) pose significant challenges in healthcare and cause increased patient suffering, longer hospital stays, and higher healthcare costs. Paediatric patients face unique risks, but evidence remains scarce. This study aimed to identify and describe HAPI admission incidence and severity predictors in a large Australian children's hospital.

Methods: This retrospective cohort study investigated all paediatric patients between January 2020 and December 2021 using a census approach. Demographic and clinical data including HAPI-related data were accessed from the incident monitoring and hospital administration databases. The incidence rate (per 1000 patient admissions) was calculated based on all admissions. Predictors of HAPI severity were identified using multivariable multinomial logistic regression. The study adhered to the STROBE guidelines for retrospective cohort studies.

Results: The HAPI incidence rate was 6.96 per 1000 patient admissions. Of the age groups, neonates had the highest HAPI incidence (15.5 per 1000 admissions). Critically ill children had the highest rate for admission location (12.8 per 1000 patient admissions). Most reported cases were stage I (64.2%). Age was associated with injury severity, with older paediatric patients more likely to develop higher-stage HAPIs. Additionally, Aboriginal and/or Torres Strait Islander patients had a higher HAPI severity risk.

Conclusion: HAPI injuries in paediatric patients are unacceptably high. Prevention should be prioritized, and the quality of care improved in Australia and beyond. Further research is needed to develop targeted prevention strategies for these vulnerable populations.

Implications for the Profession and Patient Care: This research emphasizes the need for standardized reporting, culturally sensitive care and tailored prevention strategies.

Impact: The research has the potential to influence healthcare policies and practices, ultimately enhancing the quality of patient care.

Reporting Method: STROBE guidelines.

No Patient or Public Contribution: There was no patient or public contribution to the conduct of this study.

KEYWORDS
hospital-acquired, incidence, multidisciplinary, nursing, paediatric, pressure injury, tertiary hospital

1 | BACKGROUND

Hospital-acquired pressure injuries (HAPIs) are a significant concern in healthcare settings and lead to increased morbidity, prolonged hospital stays and additional healthcare costs (Padula & Delarmente, 2019; Triantafyllou et al., 2021). These injuries result from shear, friction and/or prolonged pressure on the skin, resulting in tissue damage and breakdown and are classified into six stages according to severity; I, II, III, IV, deep tissue injury and unstageable (European Pressure Ulcer Advisory Panel et al., 2019). HAPI incidence in adult populations has been thoroughly investigated (Al Mutairi & Hendrie, 2018; Li et al., 2020) with a recent systematic review identifying that, globally, 8.4% of adults developed a HAPI during their admission, with a pooled incidence rate of 5.4 per 10,000 patient days (Li et al., 2020).

While extensive research has been conducted on adult HAPIs, contemporary literature on HAPI incidence in paediatric settings is scarce (Kottner et al., 2010), especially in an Australian context. Paediatric patients are particularly vulnerable to the development of HAPIs compared to adults and have distinct risk factors, causes and aetiologies (August et al., 2021, 2023). Incidence rates vary across studies due to differences in patient populations, healthcare settings and assessment methods. Kottner et al. (2010) reported that 7% of hospitalized children will develop a HAPI (Kottner et al., 2010) however more contemporary studies report higher numbers. A systematic review and meta-analysis by Zhang et al. (2022) revealed a pooled incidence of 13.5%, based on 30 studies, though none were from Australia (Zhang et al., 2022). Triantafyllou et al. (2021) found that 14.9% of hospitalized children developed HAPIs in a systematic review and meta-analysis involving 21 studies, with one being from Australia (Triantafyllou et al., 2021). Many studies included in these systematic reviews are now over 5 years old, and half are over a decade old. Notably, the data used in the Australian study included in Triantafyllou et al. (2021) spanned from May 2010 to May 2012 (Triantafyllou et al., 2021). Considering the incidence of reported HAPIs in paediatric patients and the potential preventability of the majority of cases, there are significant implications for clinical practice, resource allocation and the formulation of prevention strategies.

The head, face and extremities are the most frequently affected areas in paediatric patients with HAPIs (Zhang et al., 2022), whereas the sacrum, heels and hips are the most commonly affected areas in adult patients (Li et al., 2020; Rodgers et al., 2021). As compared to HAPIs in adults, an early observational study in Germany demonstrated that more than half of HAPIs in infants and newborns were associated with the use of medical devices and equipment in the care environment (Schlüer et al., 2012). These injuries are frequently caused by metabolic changes due to illness, decreased gestational age and the use of inappropriately sized medical equipment (Schlüer et al., 2012; Stellar et al., 2020). However, it's important to acknowledge the delivery of healthcare including the use of devices has evolved over the past decade, and consequently these results may not be applicable to contemporary practice. Higher rates of HAPI are often observed in intensive and critical care units compared to general paediatric wards (Razmus & Bergquist-Beringer, 2017). The distribution of PIs in paediatric patients compared to adults, as well as the distinct factors contributing to HAPIs in infants and newborns, underscores the need for specialized prevention strategies and tailored care practices in paediatric and neonatal healthcare settings.

Despite pressure injury (PI) prevention being an international priority with substantial penalties applied to the hospital if a HAPI develops (Australian Commission on Safety and Quality in Health Care, 2012; NHS England and NHS Improvement, 2019), there is a scarcity of local and national evidence on the incidence and prevalence of paediatric HAPI. International clinical practice guidelines recommend several HAPI prevention strategies including risk assessment, daily skin assessment and regular repositioning (Australian Commission on Safety and Quality in Health Care, 2012; European Pressure Ulcer Advisory Panel et al., 2019). However, these guidelines are primarily focused on adult PI prevention. While these prevention strategies are based on research evidence, adult HAPI research findings cannot be generalized to the paediatric population directly because of anatomic (e.g., differences in body composition) and physiologic (e.g., differences in skin thickness and elasticity) differences. Further, a large body of evidence shows that while HAPI prevention strategies are effective (Gaspar et al., 2019), their use in Australia and internationally remains haphazard (Chaboyer et al., 2017; Martinez-Garduno et al., 2019). However, we do not know if these adult findings might apply to paediatric HAPI prevention. As a result, children may be experiencing unnecessary harm.

Establishing a contemporary understanding of HAPI incidence in paediatric patients is imperative in understanding the burden

of this potentially preventable hospital-acquired complication. Such information will enable the identification of demographic and clinical trends over time across patient subgroups and will assist decision-makers to improve the planning and delivery of paediatric care. Additionally, understanding the predictors of paediatric HAPI severity is a critical step in developing evidence-based prevention interventions. Although well-defined in adult populations, the body of work on the incidence and characteristics of HAPIs in children is relatively scant. Yet, we know HAPI bring significance negative consequences to patients and the health system. The aim of the present study was to identify and describe HAPI incidence and its predictors of severity in a large Australian children's hospital.

2 | METHODS

2.1 | Design

A retrospective, population-based cohort study using hospital-wide activity data and data from a clinical risk management (RiskMan) reporting system was undertaken. The primary aim of this research was to measure and describe reported HAPI incidence in the paediatric patient population. Secondary aims included identifying the characteristics of paediatric patients affected by HAPI and identifying risk factors for increasing HAPI severity. The study was reported in accordance with STROBE guidelines for retrospective cohort studies (Vandenbroucke et al., 2007) (see Supplementary file 1).

2.2 | Study setting and sampling

The study was conducted at a quaternary paediatric hospital in Australia. To study the complete population in this time period a census of all included participants was used. Inclusion criteria encompassed children aged 0 to <18 years attending the hospital with a reported HAPI within the study period. Importantly, a clear distinction was made between presentations and admissions in the analysis to reduce potential biases, ensuring that the study population accurately represented the target paediatric admissions. For instance, Emergency Department (ED) presentations were excluded, while admissions to ED short stay were included. Exclusion criteria excluded incidents that were not consistent with the definition of a HAPI, for example, a different skin integrity issue like skin tears, burns or a community-acquired PI. Patients with incomplete or missing data were excluded from the analysis.

2.3 | Ethical considerations

Ethics approval was granted from the Human Research Ethics Committees of Queensland Children's Hospital (HREC/21/QCHQ/80519) and Griffith University (2021/919). Data custodian and Public Health Act approval (ref: PHA 80519) were also granted for access and use of data. Patient data were de-identified and anonymised to maintain confidentiality and comply with data protection regulations. Individual patient consent was not required.

2.4 | Data collection

Retrospective data were retrieved via a hospital-wide activity system, including the total number of patients admitted to the hospital during the data collection period and their demographic information. Data on HAPIs were gathered from the clinical incidence reporting system Riskman for the period January 2020 to December 2021. The unit of analysis for the incidence data in this study was admissions, allowing for an examination of HAPI incidence rates in the context of entire admissions. The study also investigated specific HAPI characteristics and severity, focusing on the occurrence of the first HAPI per admission.

2.4.1 | Incident reporting

HAPI incidents were recorded in an electronic safety information system (RiskMan) that documented all adverse incidents or other risks/near misses hospital wide. RiskMan integrated incident reports, clinical notes and patient records, providing a detailed repository of various hospital-acquired complications, including HAPI. Data derived from RiskMan was used within local clinical areas, enabling the scrutiny of incidents while fostering opportunities for learning and improvement. Additionally, RiskMan registers were also reported at the executive level within the health service through a clinical quality and risk committee, which actively oversaw risk management governance.

Every patient that developed a HAPI was required to have the incident formally documented within RiskMan, which served as the predominant electronic incident management system for reporting PIs in Australian healthcare facilities. Following the diagnosis of a HAPI, it was mandatory for the health professional involved or their immediate supervisor to complete a digital incident report in the RiskMan register. These reports were mandated to record injury type, severity, incident summary, and details regarding the HAPI prevention/treatment plan. In addition to this, RiskMan offered specific documentation categories for HAPIs, such as HAPI stage, location, admission source and the status of the PI on arrival, whether it was acquired, or it worsened. HAPI locations, reported in free-text boxes, were organized based on anatomical proximity. Analysis for this paper only included the first HAPI per patient per hospital admission. RiskMan did not include community-acquired PIs, as these types of injuries did not reflect hospital care and were therefore not reported in this article.

2.4.2 | All admission data (control data)

To compare characteristics and provide a denominator to calculate incidence rates, we used a local Hospital-wide activity database. Hospital-wide activity was a local database and referred to the number of days that a patient occupied a hospital bed, how the hospital bed was utilized, the length of their stay, and the overall demand for hospital beds. This data was collected by healthcare facilities, such as hospitals, as part of their routine administrative and clinical processes collected via electronic health records. Table 1 describes the variables and the sources from which they were extracted.

Patient postcodes were converted to Socio-Economic Indexes for Areas (SEIFA) categories to examine the relationship between socio-economic disadvantage and paediatric HAPI. The Australian Bureau of Statistics SEIFA index assesses locations in Australia based on their relative socio-economic advantage and disadvantages. The indices were based on data from the Census, which was conducted every 5 years (Australian Bureau of Statistics, 2023).

2.5 | Data analysis

Summary statistics are presented as frequency and percentage for categorical data and median and inter-quartile range for continuous data. Incidence of PI was calculated using Poisson regression, the association between patient characteristics and injury severity was investigated using multivariable multinomial logistic regression. The effect estimate is presented as a relative risk ratio (RRR) with a 95% confidence interval (95% CI). Data were analysed use Stata statistical software v13 (StataCorp, College Station, TX, USA).

3 | RESULTS

Data were extracted from the hospital-wide activity system for 579,951 visits. Exclusions were made for outpatient appointments (405,208 visits) and emergency department presentations (96,989 visits), leaving 77,845 admissions that met the study's inclusion criteria. Additionally, Riskman was queried for reported HAPI's during the same period, resulting in 679 identified cases. After exclusions due to insufficient data (4 cases) and misclassification (21 cases), the final dataset comprised 654 HAPI, spanning 542 admissions and 420 patients that met the study's inclusion criteria. See Supplementary file 2. Participant flow diagram for more information. Table 2 illustrates length of stay (LOS) data for both admission and HAPI data. The admission data signified shorter stays, while the Riskman data reported both a higher average and median demonstrating more variability.

TABLE 1 Data collection sources.

Variables	RiskMan	Hospital-wide activity
Demographics (age, gender, first nations status, residential postcode)	Y	Y
Hospital admission characteristics (length of hospital stay, admission division)	Y	Y
HAPI-related data (stage, body location, potential cause, treatment plan)	Y	

3.1 | Patient demographics and HAPI incidence rates

HAPI incidence was 6.96 per 1000 patient admissions. When considering age, neonates had the highest HAPI incidence (15.5 per 1000 patient admissions), which was significantly higher than School-aged children (5 < 12 years) (incidence rate ratio [IRR] = 2.60; 95% CI: 2.03, 3.32). First Nations children had an admission incidence rate of 6.8 per 1000 admissions, compared with 5.6/1000 in their non-First Nations peers, indicating a potential increased risk. Children from more disadvantaged backgrounds were more likely to have a HAPI (IRR = 2.17; 95% CI 1.75, 2.70 and 1.39, 95% CI 1.12, 1.72) for disadvantaged compared with highly advantaged and advantaged respectively. When considering hospital divisions, children within the critical care division had the highest HAPI incidence rate (12.8 per 1000 admissions), with an IRR of 2.32 compared to the surgery and perioperative services division. Medicine had the lowest incidence (4.2 per 1000 admissions) with IRR of 0.76, 95% CI 0.60, 0.97. The incidence rates and descriptive characteristics of HAPI incidents and all other paediatric admissions are presented in Table 3.

3.2 | Characteristics of patients with HAPI

The distribution of characteristics for the first HAPI per patient admission is presented in Table 4. Overall, 64.2% of reported HAPIs were Stage I pressure injuries, 24.9% were Stage II pressure injuries, 1.5% were Stage III pressure injuries, and 0.4% were Stage IV pressure injuries. The most frequently reported HAPI site was the head, including the neck, face, ears, lips and mouth, accounting for 29.5% of cases. Other affected areas included the lower limbs (legs, ankles,

TABLE 2 Length of stay (LOS) of both populations.

	Median LOS	Interquartile range (IQR)	Minimum LOS	Maximum LOS
All admission data (control data)	0 days	4.2 days	0 days	490 days
HAPI-related data (Riskman)	12.5 days	34 days	0 days	506 days

TABLE 3 Descriptive characteristics of both populations and HAPI incidence rates.

	Riskman data *n* (%) (total admissions = 542)	Bed day data *n* (%) (total admissions = 77,845)	Incidence rates (95% CI) per 1000 admissions	Incidence rate ratio (95% CI)
Age				
Neonate <28 days	125 (23.1)	8050 (10.3)	15.5 (12.9, 18.5)	2.60 (2.03, 3.32)
Infant 28 days to <1	7 (1.3)	1863 (2.4)	3.8 (1.5, 7.7)	0.63 (0.25, 1.33)
Toddler 1 to <3	77 (14.2)	13,640 (17.5)	5.6 (4.4, 7.1)	0.95 (0.71, 1.25)
Pre-schooler 3 to <5	47 (8.7)	10,029 (12.9)	4.7 (3.4, 6.2)	0.78 (0.55, 1.10)
School-aged 5 < 12	147 (27.1)	24,594 (31.6)	6.0 (5.0, 7.0)	1.00 (ref.)
Teenager >12	139 (25.6)	19,669 (25.3)	7.1 (5.9, 8.3)	1.18 (0.93, 1.50)
Gender				
Male	308 (56.8)	43,801 (56.3)	7.0 (6.3, 7.9)	1.00 (ref.)
Female	234 (43.2)	34,002 (43.7)	6.9 (6.0, 7.8)	0.98 (0.82, 1.16)
First nations status				
Non-indigenous	399 (73.6)	71,083 (91.3)	5.6 (5.1, 6.2)	1.00 (ref.)
Aboriginal and/or Torres Strait Islander origin	45 (8.3)	6620 (8.5)	6.8 (5.0, 9.1)	1.21 (0.87, 1.65)
Socio-Economic Indexes for areas				
Disadvantaged (1–3)	187 (34.5)	17,304 (22.2)	10.8 (9.3, 12.5)	2.17 (1.75, 2.70)
Advantaged (4–7)	195 (36.0)	28,212 (36.2)	6.9 (6.0, 8.0)	1.39 (1.12, 1.72)
Highly advantaged (8–10)	160 (29.5)	32,153 (41.3)	5.0 (4.2, 5.8)	1.00 (ref.)
Division				
Critical care	245 (45.2)	19,202 (24.7)	12.8 (11.2, 14.5)	2.32 (1.90, 2.85)
Medicine	117 (21.6)	27,955 (35.9)	4.2 (3.5, 5.0)	0.76 (0.60, 0.97)
Surgery and perioperative services	163 (30.1)	29,681 (38.1)	5.5 (4.7, 6.4)	1.00 (ref.)
Other	17 (3.1)	1007 (1.3)	16.9 (9.8, 27.0)	3.07 (1.74, 5.06)

Note: Missing data: Riskman: first nations status $n = 98$; Bed days: Gender $n = 42$, first nations status $n = 142$, SEIFA $n = 176$. Critical care includes a paediatric intensive care unit, emergency short stay, medical imaging and anaesthetics. Medicine includes rehabilitation and oncology.

feet, malleolus and toes) (21.4%) and upper limbs (arm, elbow, finger, hand and wrist) (20.2%).

3.3 | PI severity and potential risk factors

The association between the PI stage and potential risk factors was explored using multivariable multinomial logistic regression analysis, with Stage I as the reference outcome (Table 5). Age emerged as a significant factor associated with PI stage, particularly Stage II, revealing that with each 1-year increase, there was a 1.06 (95% CI 1.02–1.09) times higher likelihood of Stage II compared to Stage I, while keeping other factors constant. First Nations status was also significantly linked to a higher relative risk of Stage III/IV (RRR: 8.21, 95% CI 1.51–44.57) compared to Stage I, after adjusting for other variables.

The division of care service/location significantly influenced the relative risk of HAPIs, particularly for Stage II. Critical care, medicine and surgery divisions displayed notably higher relative risks for patients being in Stage II HAPIs. In the medicine division, the relative risk ratio was 2.09 for experiencing Stage II compared to Stage I (vs. Critical care). In the surgery division, the relative risk ratio was 2.50 for Stage II compared to Stage I (vs. Critical care), holding other factors constant. Patients in the "other" division category had a relative risk ratio of 4.35 for Stage II compared to Stage I (vs. Critical care), with all other factors held constant. Patient gender and SEIFA code did not exhibit a significant impact on the relative risk of stage progression.

4 | DISCUSSION

Between January 2020 and December 2021, a total of 542 HAPIs were reported by clinicians in 420 paediatric patients at an Australian quaternary paediatric hospital, resulting in a HAPI

admission incidence rate of 6.96 per 1000 patient days. Notably, neonates, patients in critical care, and those from disadvantaged socio-economic backgrounds showed elevated HAPI incidence rates. First Nations children had significantly increased odds of acquiring a more severe classification of HAPI compared to non-Indigenous children.

TABLE 4 Pressure injury characteristics (first HAPI per admission).

n = 542	
Location	
Head, neck, face, ears, lips, mouth	160 (29.5)
Lower limb (leg, ankle, foot, malleolus, toes)	116 (21.4)
Upper limb (arm, elbow, finger, hand, wrist)	110 (20.2)
Lower back/pelvis (sacrum, coccyx, greater trochanter, buttocks, hip, spine)	67 (12.4)
Heels	61 (11.3)
Other	19 (3.5)
Upper back, scapula, spine	9 (1.7)
Stage	
Stage I	348 (64.2)
Stage II	135 (24.9)
Stage III	8 (1.5)
Stage IV	2 (0.4)
Suspected deep tissue injury	4 (0.7)
Unstageable	8 (1.5)
Mucosal membrane	32 (5.9)
Not stated	5 (0.9)

4.1 | Critical considerations on low event rate

The overall percentage of hospital admissions with a reported HAPI found in this study was 0.7%, which is significantly lower than previous reports (Kottner et al., 2010; Triantafyllou et al., 2021), especially when compared to a recent meta-analysis reporting a pooled incidence of 13.5% (Zhang et al., 2022). This low rate may be attributed to the reliance on documentation within the RiskMan software, which raises concerns about potential under-recognition and a culture of under-reporting of HAPIs. It is crucial to acknowledge that reporting culture plays a nuanced role in the accuracy of data, as factors such as time constraints, inadequate education, and suboptimal documentation practices could collectively lead to an underreporting bias (Carlfjord et al., 2018). Consequently, this bias may skew the data towards a lower incidence rate, potentially misrepresenting the true prevalence of HAPIs.

4.2 | HAPI location and high-risk areas

The study's findings reveal that the most frequently reported body site for paediatric HAPIs was the head, which includes the neck, face,

TABLE 5 Association between patient characteristics and HAPI stages. Analysis from multivariable multinomial logistic regression.

	Relative risk ratio (95% confidence interval)		
	Stage II	**Stage III and IV**	**Suspected deep tissue injury and unstageable**
	***n* = 135**	***n* = 10**	***n* = 12**
Age	1.06 (1.02–1.09)**	1.00 (0.88–1.12)	1.12 (0.99–1.25)
Sex			
Male	1.00	1.00	1.00
Female	1.06 (0.70–1.61)	1.29 (0.35–4.74)	1.71 (0.50–5.81)
SEIFA			
Disadvantaged	1.00	1.00	1.00
Advantaged	0.94 (0.57–1.57)	0.85 (0.17–4.27)	0.28 (0.05–1.41)
Highly advantaged	1.21 (0.72–2.03)	1.31 (0.25–6.76)	0.54 (0.13–2.26)
First nations status			
Non-indigenous	1.00	1.00	1.00
First nations	0.86 (0.38–1.98)	8.21 (1.51–44.57)*	1.07 (0.12–9.82)
Division			
Critical care	1.00	1.00	1.00
Medicine	2.09 (1.21–3.58)**	4.70 (0.69–32.16)	3.84 (0.66–22.33)
Surgery	2.50 (1.52–4.14)***	5.23 (0.90–30.37)	3.69 (0.68–20.21)
Other	4.35 (1.36–13.89)*	0.00 (n/c)	20.21 (1.44–283.13)*

Abbreviation: n/c, not computable.

*p-value <.05; **p-value <.01; ***p-value <.001.

ears, lips and mouth. HAPIs in these areas are often device-related and are commonly associated with nasogastric feeding tubes, ventilation tubes or continuous positive airway pressure masks with prongs (Schlüer, 2017). However, PI on the face may be inherently more noticeable, potentially leading to more frequent reporting rather than a higher actual occurrence. These findings align with previous reports by Kottner et al. (2010) and Zhang et al. (2022), which also found HAPIs located on the head to be the most common occurrence in paediatric patients, followed by sacrococcygeal locations (Kottner et al., 2010; Zhang et al., 2022). Understanding these specific high-risk areas informs healthcare providers in implementing targeted prevention strategies. By focusing on these areas, healthcare professionals can educate parents and caregivers on safety measures and implement interventions to reduce the incidence of HAPIs in children, ultimately contributing to overall patient safety.

4.3 | Age as a significant factor

Neonates, with an incidence rate of 15.5 per 1000 admissions, demonstrated a high risk, supported by an Incidence Rate Ratio (IRR) of 2.60 compared to the reference group. Additionally, this study highlights age as a significant factor influencing HAPI stage, with each year increase in age increasing the likelihood of experiencing a Stage II HAPI compared to Stage I. Older paediatric patients may be more vulnerable to developing Stage II HAPI compared to their younger counterparts. While Razmus (2018) also found HAPI rates peaking for children aged 9–18 years (1.6%) and 5–8 years (1.4%), with the lowest HAPI rates observed among patients aged 1–30 days (0.72%), no regression was performed on the stages of PI (Razmus, 2018). Although there has been a recent focus on HAPIs sustained by neonates, suggesting that decreased gestational age and the use of medical devices are risk factors for this vulnerable sub-population (Schlüer et al., 2012), no further work has been undertaken to understand the relationship between age and stages of PI severity.

4.4 | Division of care impact on HAPI risk

With regards to division of care, critical care exhibited the highest incidence rate (12.8 per 1000 admissions) and an IRR of 2.32, while medicine demonstrated a lower incidence rate with a protective effect (IRR of 0.76). These findings align with prevailing evidence that often reports a higher HAPI incidence among children in critical care units (Razmus, 2018; Razmus & Bergquist-Beringer, 2017; Zhang et al., 2022). Additionally, the division of care within the hospital emerged as a significant factor affecting HAPI severity risk, but with patients in medicine, surgery, and "other" category divisions having higher odds of experiencing Stage II HAPI compared to those in critical care, even after accounting for other factors.

The influence of reporting culture and the nuance of increasing severity should be considered. As seen in this case, higher reporting rates may not necessarily result in worse outcomes; often, the opposite is true. The detection of PIs can vary significantly depending on the intensity of their detection (Weller et al., 2018). In fact, a culture of reporting and monitoring can lead to early detection and intervention, ultimately improving patient outcomes. Additionally, the increased severity of HAPI in critical care units may be attributed to the complex medical conditions and prolonged immobility that these patients often experience. Therefore, it is crucial to interpret the incidence rates of HAPI in different settings with caution and consider the unique factors that contribute to its development.

Maintaining skin integrity in the critical care environment is challenging but not impossible due to complex treatments, patient immobilization and other health issues, which can increase the risk of HAPIs (Zhang et al., 2022). Evidence-based strategies from critical care literature for alleviating pressure from mechanical devices include regular patient repositioning, using protective dressings to cushion the skin and ensuring proper fitting and monitoring of medical equipment (Black et al., 2015; Gefen et al., 2020).

4.5 | Disparities in first nations children

First Nations children exhibited higher HAPI incidence rates compared to their non-Indigenous counterparts. This disparity was even more pronounced when considering the occurrence of more severe stages of HAPI, particularly Stages III & IV. These findings align with broader Australian research that consistently highlights profound disparities experienced by First Nations children (Ingram et al., 2023; Justo et al., 2017). It's crucial to note that for indigenous status, 25% of children with HAPIs had "unknown" or "not stated" recorded, potentially reflecting the complex and sensitive issue of self-identification among First Nations families during hospital stays. The historical impact of colonization on Australian healthcare systems and the intergenerational trauma from the forced removal of Indigenous children have been known to lead some families to hesitate in identifying as Aboriginal or Torres Strait Islander when seeking care (Nolan-Isles et al., 2021). First Nations children often experience longer hospital stays, higher rates of unintentional injuries, delayed diagnosis and treatment, and increased vulnerability to various injury patterns compared to their non-Indigenous counterparts (Ingram et al., 2023; Möller et al., 2017). This stark disparity underscores the urgent need for improved healthcare access, as well as the necessity of culturally sensitive care, education and targeted interventions.

4.6 | Strength and limitations

This study addresses an under-studied area, providing current HAPI incidence data and risk factors within our specific context, however, it has both strengths and limitations. The study's retrospective nature and reliance on available incident reports facilitated easy data collection and created less burden for patients. However, this also resulted in the analysis being bound by the data accessible in these reports. Incomplete reporting or misclassification of incidents may

also affect the overall accuracy of the reported incidence rates and characteristics of HAPIs. Future studies could benefit from employing a multi-faceted approach, including direct patient assessments and continuous education of healthcare professionals to improve reporting accuracy. The generally wide confidence intervals in some of the reported results highlight some uncertainty associated with these estimates. Nevertheless, a strength of this study is its large sample size, with all hospital admissions during the study period being included in the dataset. It's crucial to acknowledge that this study was conducted at a single quaternary hospital, which may limit the generalisability of the findings to other healthcare settings but offers a unique insight into our specific hospital context. These nuances should be considered when guiding healthcare interventions and further research efforts. Despite certain limitations, this study contributes valuable information to the existing knowledge on paediatric HAPI and underscores the need for further research in this area.

4.7 | Implications for policy and practice

This study highlights the critical need for a standardized and comprehensive approach to reporting and documenting HAPIs. Such an approach is essential to improve the accuracy of data collection and to gain a more comprehensive understanding of HAPI incidence among paediatric patients. Additionally, the distinct characteristics and risk factors observed among paediatric patients and emphasizes the need for tailored prevention strategies. Standard adult prevention measures might not be directly applicable to paediatric cases, given the anatomical and physiological differences between the two populations. Current screening tools aimed at preventing HAPIs pose a substantial obstacle for multidisciplinary paediatric clinicians in their efforts to mitigate these injuries (Dimanopoulos et al., 2023). Education and interventions should be targeted, focusing on the proper use and sizing of medical devices known to cause HAPIs, such as nasogastric feeding tubes and CPAP masks. Clinical practice approaches like care bundles and prophylactic dressings play a pivotal role in preventing device-related HAPI. Notably, the implementation of a care bundle, including daily assessments and device checks integrated into electronic medical records, significantly reduced tracheostomy-related PI in paediatric patients transitioning from quaternary care to home care (Boesch et al., 2012). While there isn't a commercially designed dressing specifically for preventing medical device-related PI, dressings providing skin cushioning have shown a significant decrease in PI incidence (Black et al., 2015; Cai et al., 2019).

Considering the pronounced disparities reported in this study among First Nations children, strategies also must incorporate cultural sensitivity and inclusivity. This finding raises important questions about the potential underlying causes, including systemic factors, cultural considerations, or differences in care delivery. Ultimately, the scarcity of local and national evidence on the prevalence of paediatric HAPIs underscores the importance of this study. The findings have significant implications for policy and practice in paediatric care settings and illustrate that paediatric HAPI prevention should be prioritized, and prevention strategies should be developed based on the specific risk factors and characteristics observed in this population.

4.8 | Recommendations for further research

To expand our understanding, data on other patient demographic and medical characteristics not routinely captured in Riskman, like the presence/extent of traumatic injury, length of immobilization and presence of devices, should be examined to better predict HAPI risk in our population. Prospective, longitudinal studies are essential for a deeper understanding of the development and risk factors related to paediatric HAPI. These studies should consider specific variables relevant to paediatric HAPI risk assessments, investigating the utilization of a HAPI risk assessments and the impact of varying interventions within the hospital setting. This research would contribute to a more nuanced and valuable understanding of preventative measures and healthcare practices. Additionally, future research should encompass multiple sites to enhance generalisability and encompass diverse paediatric populations. Qualitative research delving into the experiences and perceptions of healthcare professionals, paediatric patients and their caregivers regarding HAPI prevention and care would provide a more comprehensive perspective. To address the disparities observed in the incidence of more severe HAPI among First Nations patients, investigating the influence of socioeconomic factors and cultural determinants on paediatric HAPIs is vital for more inclusive preventive approaches. Further research in this area is essential to continue refining prevention interventions and reducing the incidence of paediatric HAPIs, ultimately improving the quality of care for paediatric patients in Australia and beyond.

5 | CONCLUSION

In conclusion, this study contributes valuable insights into the admission incidence in the paediatric population within an Australian children's hospital. This study identified age, first nations status and division of care as factors associated with both HAPI incidence and increased HAPI severity. The findings emphasize the need for tailored prevention strategies, culturally inclusive education, improved equity in care delivery and further research to address the unique challenges presented by paediatric HAPIs. By focusing on these aspects, healthcare providers and policymakers can work together to enhance the quality of care for paediatric patients and reduce the occurrence of preventable HAPIs.

AUTHOR CONTRIBUTIONS

WC, AJU, JC and BRG contributed to the development and design of the study. BRG acquired research funding. TD, WC, AJU, JC and BRG were involved in data collection, analysis and interpretation. TD prepared the manuscript. RSW and MP were the statisticians in the

study. All authors provided review and edits of the draft manuscript and approved the final manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

PEER REVIEW

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

Ethics approval was granted from the Human Research Ethics Committees of QCH, HREC/21/QCHQ/80519 and Griffith University (2021/919). Individual patient consent was not required. Data custodian and Public Health Act approval (ref: PHA 80519) were also granted for access and use of data.

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SUPPORTING INFORMATION

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

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