BMJ Open

Do they stay, or do they go? Children presenting to five emergency departments across New South Wales, Australia with acute burn injuries: a retrospective review

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To cite: Phillips W, Southern E, Cattell C, *et al*. Do they stay, or do they go? Children presenting to five emergency departments across New South Wales, Australia with acute burn injuries: a retrospective review. *BMJ Open* 2024;**14**:e079306. doi:10.1136/bmjopen-2023-079306

► Prepublication history for this paper is available online. To view these files, please visit the journal online (https://doi.org/10.1136/bmjopen-2023-079306).

WP since deceased.

Received 28 August 2023
Accepted 30 January 2024

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ABSTRACT

Objective The overall objective of the study was to describe the disposition status of children presenting with a burn injury to five emergency departments (ED) across New South Wales (NSW), Australia.

Design A retrospective study design was used to review routinely collected ED data.

Setting Study sites included five acute hospitals across NSW, Australia.

Participants During the 5-year study period between 1 January 2015 to 31 December 2020, there were 5213 paediatric burn injury presentations.

Results The mean age of burn injury presentations was 24 months (Inter-Quartile-Range (IQR) 12–84), of which 57% (2951/5213) were males. The most common presentation time was between 16:00 and 23:59 hours (63%, 3297/5213), and the median time spent in the ED was 3 hours (IQR 1–4). The majority (80%, 4196/5213) of the burn injuries presentations did not require hospital admission. The most common principal diagnoses were 'Burn body region unspecified' (n=1916) and 'Burn of wrist and hand' (n=1060).

Conclusion Most children who presented to the hospital with a burn injury were not admitted. Often the details of these burns were poorly recorded and a complete picture of the true burden of burn injury in children, especially the ongoing care given outside the acute hospital setting, is missing. This information is crucial, as it would inform future models of care as the paradigm shifts rapidly towards primary, ambulatory and outpatient models of care.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Our results can be considered representative of the Australian setting due to a large number of paediatric presentations to various emergency departments, including both metropolitan and rural areas.
⇒ A limitation of our analysis is that the specific details of the cause, circumstance and severity of the burn injury are missing from our analysis as it is based on routinely collected hospital data.
⇒ Furthermore, we have results that are limited to the emergency department admission only.

INTRODUCTION

It is well recognised internationally that burn injuries sustained by children are associated with high levels of morbidity and result in significant economic costs to the community.[1] Although largely preventable, burn injuries in children cause both physical and psychological trauma to the child and the family, regardless of the severity of the injury, resulting in lengthy disruption to family life and loss of income.[1–4] Most published data, characterising children who sustain a burn, is focused on those whose injury is significant enough to warrant admission to a specialised burn unit. Internationally, this cohort of children has been described as being between 4% and 26% of all burn presentations.[2 5]

The impact on children who sustain a burn injury and do not require admission to a specialist burns unit has not been well described.[6–8] Although these burn injuries are often described as minor, they are not insignificant and will cause pain and psychological trauma, and can take months of treatment and therapy to restore normal function.[9] Importantly, this cohort may represent up to 90% of all emergency presentations following a burn.[10–12] Therefore, this study was designed to describe the disposition status of children presenting with a burn injury in five emergency departments (ED) across New South Wales (NSW), Australia, in particular, the proportion of children who do not require hospital admission. The five hospitals were chosen based on their locality

Table 1 The number of burn injury presentations, total number of paediatric presentations and the age, sex, arrival time, length of stay in the department and disposition status of children presenting with a burn injury

	Burns presentations						
	Campbelltown Hospital (n=585)	Fairfield Hospital (n=244)	The Westmead Children's Hospital (n=3139)	Wagga Wagga Hospital (n=603)	Wyong Hospital (n=642)	Total (n=5213)	P value
Total no of ED presentations (burns/1000)	108 905 (5.37)	43 625 (5.59)	315 501 (9.9)	54 762 (11.1)	92 317 (6.95)	615 110 (8.48)	<0.001
Age (months), median (IQR)	36 (12–108)	36 (12–96)	24 (12–60)	48 (12–120)	72 (24–156)	24 (12–84)	<0.001
Males, n (%)	337 (58)	118 (48)	1810 (58)	333 (55)	353 (55)	2951 (57)	0.056
Arrival time, n (%)							<0.001
24:00–07:59	23 (4)	12 (5)	294 (9)	25 (4)	25 (4)	379 (7)	
08:00–15:59	149 (25)	64 (26)	929 (30)	234 (39)	161 (25)	1537 (29)	
16:00–23:59	413 (71)	168 (69)	1916 (61)	344 (57)	456 (71)	3297 (63)	
ED length of stay (hours), median (IQR)	2 (1–3)	2 (1–3)	3 (2–4)	2 (1–3)	2 (1–3)	3 (1–4)	<0.001
Discharged home treatment complete, n (%)	470 (80)	225 (92)	2323 (74)	555 (92)	623 (97)	4196 (80)	<0.001

ED, emergency department.

and their paediatric capability in managing burn injuries through inpatient and outpatient facilities. It is envisaged that this group of hospitals will provide a representative sample of patient disposition status.

METHODS

Subjects and setting

The five hospitals included in our retrospective review of paediatric burn injury presentations included (1) Fairfield Hospital; (2) Campbelltown Hospital; (3) Wyong Hospital; (4) Wagga Wagga Base Hospital and (5) The Children's Hospital at Westmead (CHW). A brief description of each of these hospitals is as follows:

1. The Fairfield Hospital is a small metropolitan hospital located in South Western Sydney (SWS) with 230 adult and paediatric (mixed) beds and an outpatient clinic for paediatric burns.
2. Campbelltown Hospital is a major metropolitan hospital located in SWS with 306 mixed beds and an outpatient clinic for paediatric burns.
3. Wyong Hospital is a metropolitan hospital located on the central east coast of NSW approximately 100 km north of Sydney, with 340 adult beds and an outpatient clinic for paediatric burns.
4. Wagga Wagga Base Hospital is a large rural hospital located approximately 400 km south-west of Sydney with 325 mixed beds, and an outpatient clinic for paediatric burns.
5. CHW is a 340-bed tertiary referral facility for paediatrics, with a specialist inpatient and outpatient burns unit. It is located in the western suburbs of Sydney. CHW is the sole tertiary referral centre for paediatric burns for the state of NSW.

Routine collected ED data

The review included routinely collected data on all children aged 0–16 years who presented to the ED of these five hospitals between 1 January 2015 and 31 December 2020; data were extracted from the NSW Health Information Exchange interface (HIE). The HIE is a centralised warehouse of health-related information under the NSW Department of Health.[13] Diagnosis codes describing the primary diagnosis for the ED presentations are mainly undertaken using the Systematized Nomenclature of Medicine—Clinical Terms (SNOMED-CT). Our candidate SNOMED codes related to burns were initially explored using the descriptors and searching for 'burn' or 'scald'. However, one of the hospitals had initially used the International Classification of Diseases—Tenth Revision—Clinical Modification (ICD-10-CM) for 3 years (2015–2018) before switching to SNOMED-CT. Therefore, in an attempt to ensure accuracy and consistency within our data, we decided to use ICD-10-CM parent (3-digit) coded to identify burns codes (T20–T31) and mapped these to SNOMED using the National Library of Medicine (NLM) SNOMED CT to ICD-10-CM conversion

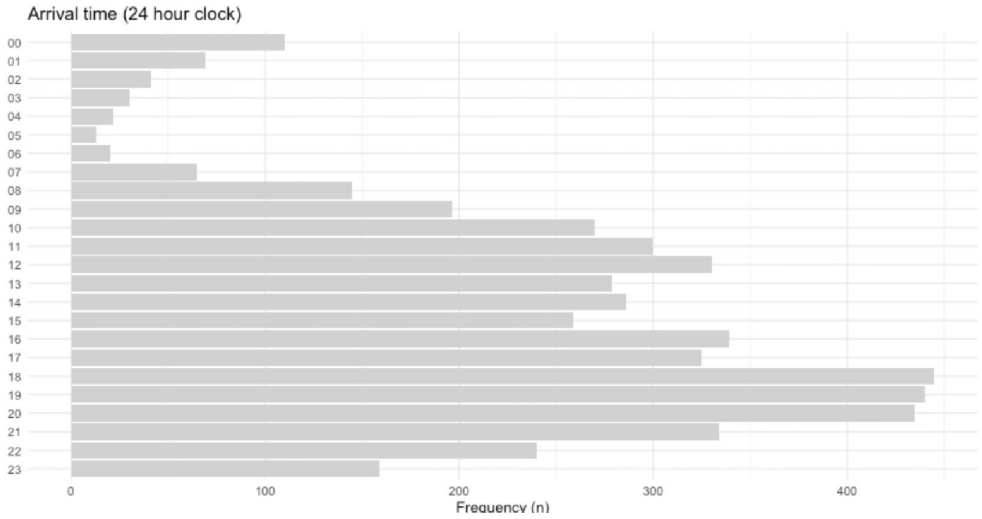

Figure 1 Arrival time to the emergency department (ED) for burn injuries (24-hour clock).

map.[14 15] The mapping process was undertaken using the SAS V.9.4.

Statistical analysis

The age, sex and disposition status of children presenting with a burn injury have been summarised using descriptive statistics, using frequencies and rates, a mean and SD, or a median and IQR when appropriate. The time of burn injury presentation was collapsed into three categories: morning (06:00–12:00), evening (12:00–24:00) and overnight (24:00–06:00). The types of burns were described using 11 data points: T20–T31 (ICD-10-AM three-digit parent codes). The age, sex and disposition status of children presenting with a burn injury of presentations between study sites were compared using inferential statistics using the R language for statistical computing; all levels of statistical significance were set at 0.05.[16]

Patient and public involvement

None.

RESULTS

This report describes the age, sex and disposition status of children presenting with burn injuries to five EDs across NSW, Australia. A summary of the total number of ED presentations and what proportion of these were burn injury presentations is presented in table 1. During the 5-year study period, there were 5213 burn injury presentations among 615 110 total paediatric presentations, resulting in a rate of 8.48 burn injury presentations per 1000. The mean age of burn injury presentations was 24 months (IQR 12–84), of which 57% (2951/5213) were males. The most common presentation time was between 16:00 and 23:59 (63%, 3297/5213) (figure 1), and the median time spent in the ED was 3 hours (IQR 1–4). The majority (80%, 4196/5213) of the burn injuries presentations did not require hospital admission. The most common principal diagnosis was 'Burn body region unspecified' (n=1916) and 'Burn of wrist and hand' (n=1060) (figure 2).

DISCUSSION

Our data indicate more males than females, and that three-quarters (75%) were aged 7 years or less presented with a burn injury. Consistent with numerous reports internationally, the number of children admitted or transferred to a tertiary facility was significantly lower (1 in 10) when compared with those discharged after initial emergency care.[2 5 6 17] The main aim of our study was to describe the disposition status of children presenting with a burn injury, providing more meaningful data so that models of care can be more meaningfully aligned with burn injuries that require admission and those that do not.

Males and preschoolers were most of the burn injury presentations in this retrospective study. Similar results have been previously reported in developed countries.[12 18 19] Toddlers and preschool children are often seen to be exploring their world with little understanding for their own safety. For this reason, the large amount of hand and wrist burns are where children might touch, grab or pull on hot objects in the kitchen.

The large number of burns coded as unspecified under ICD-10 (T-30) may indicate that more care should be taken when documenting burn injuries in the ED clinical notes. The relationship between poor documentation of burn injuries and coding difficulties is well described in the literature.[20] In addition, inaccurate documentation of burn injuries by health services will result in poor reimbursement of care to hospital finances, and inhibit the ability of researchers to obtain meaningful data on burn injuries.[21 22] A specific measure to improve the documentation of burn injuries in primary healthcare could be achieved by specific renumeration of general practices to care for these patients, and the inclusion of paediatric burn injury cared for outside the acute care

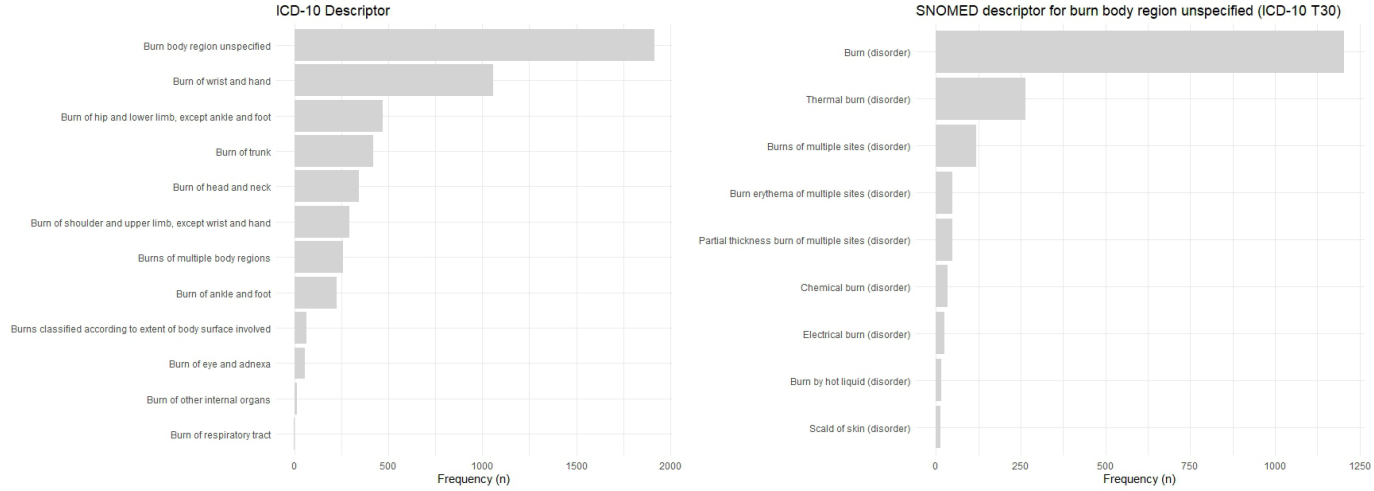

Figure 2 Distribution of diagnosis codes (ICD-10 left panel), and SNOMED descriptor for ICD-10 T30 (burn body region unspecified) right panel. ICD-10, International Classification of Diseases—10th Revision; SNOMED, Systematized Nomenclature of Medicine.

setting to the current inpatient registries. These measures would increase the availability of data to describe the true burden of burn injuries in the paediatric population.

We observed that most paediatric burn presentations to ED occurred in the evening. This is consistent with reports describing paediatric burns involving food items or beverages occurring predominantly in the home environment in the kitchen during meal preparation times.[4 6 12] Conversely, hospitals tend to have more high-level skilled clinical staff and managers working during business hours (08:30–17:00). Presenting with a burn injury to a hospital at an hour where resources are scarcer may directly affect outcomes such as wait times, initial assessment, treatment and disposition.

In developed countries where paediatric burn mortality is low and primary care resources are more easily accessed, the management of paediatric burn injuries through specialist outpatient clinics or general practitioners is becoming more common.[12 23] Burn injuries presenting to an ED are classified in NSW Australia as either requiring (1) immediate retrieval, (2) referral to a tertiary burns service or (3) a minor burn. Minor burns are those that do not meet the criteria for retrieval or transfer and can be managed on an outpatient basis.[24] Factors such as age, burn total body surface area, burn depth, residential location and the availability of outpatient or primary care resources are all influential in the decision to treat paediatric burn injuries on an inpatient or an outpatient setting.[8 10 19] Paediatric burns tend to be smaller, more superficial and the majority of partial thickness burns will normally heal without long-term sequelae.[25] In addition, modern popular dressings require infrequent changing and can dwell unchanged for up to 7 days.[26] These reasons have encouraged a growing trend towards managing paediatric minor burn injuries on an outpatient basis.[19] In contrast, developing countries continue to see high mortality and high admissions rates regardless of burn assessment. This is most likely due to geography, timely access and a lack of specialist resources.[3 4]

Based on our findings, there is clearly a need for the provision of health services focused on burn management post ED presentation. Outpatient services or home-based nursing services with specialist burn skills are uncommon in most healthcare facilities but would ensure a cost-effective process for ensuring that children discharged from ED with a burn injury receive quality care and are not lost to follow-up.[8] The provision of adequate pain management, sedation techniques, dressings, health education and health promotion related to burn injury in children are all possible outside of the inpatient setting and should be considered as part of healthcare planning models moving forward. Further to this, any model of care to support these paediatric patients with burn injuries will need to be acceptable and feasible to both patients, families and treating clinicians. Simply suggesting that a primary health provider will need to care for these patients may not address obstacles to many families having a general practitioner and the skills and resources these primary health provider will require to ensure the highest quality of care.

Strengths and limitations

A strength of this study is the multicentre and 5-year period of data collection. The five different hospitals, with contrasting paediatric capabilities, represent a diverse source population of both metropolitan and rural paediatric populations. A limitation of this study was the use of routinely collected ED data, which lacked specific details of the burns' location, severity and cause. A more specific description of these data would be obtained through the development of a registry.

Burn data in the paediatric population remains heavily skewed towards those children whose injuries warrant an inpatient stay. Although the great majority of children who present to the ED with a burn injury are not admitted, outpatient paediatric burn data are sparse. These data would complete a picture of the true burden of burn injury in

children and inform future models of care, as the paradigm shifts rapidly towards primary, ambulatory and outpatient models of care. Short of being given a repository of its own, outpatient burns data must, at a minimum, be added to the current inpatient burn data repositories already existing globally. Such data would enable better planning for resources needed to care for these patients and ensure continuing quality improvement. Although not requiring admission, such burn injuries in children are not insignificant. In some cases, they require long-term care and can result in both physical and psychological scarring. Treatment options for children not requiring admission to a burns unit appear to be unknown. This raises the question of whether these children are lost to follow-up and may be living with poor clinical outcomes. Further research is required to explore treatment options, outcomes, readmission rates, patient pain levels, the use of sedation for dressings and anxiety management in the ambulatory/outpatient setting. We plan to further explore the nature and outcomes of children with burn injuries who are cared for in the outpatient setting.

CONCLUSION

Most children who present to the hospital with a burn injury are not admitted. Often the details of these burns are poorly recorded and a complete picture of the true burden of burn injury in children, especially the ongoing care given outside the acute hospital setting, is needed. This information would inform future models of care as the paradigm shifts rapidly towards primary, ambulatory and outpatient models of care.

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Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Ethical approval for the study was given by the South Western Sydney Human Research Ethics Committee (2021/ETH12471). Given the retrospective nature of the project and the use of routinely collected data, a waiver of consent was granted and permission was obtained from the respective data custodians to access the HIE Emergency Department Data Collection.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. The project's data source is governed by specific data custodians and access to the data would need to be sought via these custodians.

Author note The final acceptance of the manuscript has been after the first author Wayne Phillips passed away following a short illness. Wayne devoted his specialist paediatric nursing career to improving the quality of care for children, in particular among those followng a burn injury.

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