MONASH University

BURNS REGISTRY OF AUSTRALIA AND NEW ZEALAND (BRANZ)

ANNUAL REPORT 2018/19

CONTENTS

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FOREWORD

This report marks 10 years of co-operative effort in the ongoing evolution of the Burns Registry of Australia and New Zealand. The registry was established to provide cohesive reporting across the two nations regarding burn epidemiology and treatment, with the aim of minimising the incidence and severity of injury and ensuring the best treatment of those who are injured.

Our 10-year milestone also coincides with the completion, in 2019, of a 2-year HCF Research Foundation study using BRANZ data to quantify variation in practice in the management of serious burn injury between Australia and New Zealand burn units. This study showed significant variation in areas of practice fundamental to burn care between Australian and New Zealand burns units, and this is associated with differences in patient outcomes. This information provides the rationale for the establishment of a Burns Quality Improvement Program, which will provide the framework to identify practices associated with better patient outcomes, support quality improvement projects in burns units, and monitor the impact of changing practice on patient outcomes and hospital performance.

The reporting period also marks 10 years since the Victorian Black Saturday bushfires, and is published in the aftermath of the New Zealand White Island volcano eruption: events that demonstrate the importance of our specialist burns units in responding to mass casualties, and the value of ongoing clinical collaborations to deliver best practice burn care in every circumstance.

The BRANZ is a central component of burns clinicians' collective endeavours for more consistent, better quality burn care across Australian and New Zealand burns units and improved outcomes for all our patients, and we commend this report to you.

Heather Cleland

Chair
BRANZ Steering Committee

Jeremy Rawlins

President
Australian and New Zealand Burns Association

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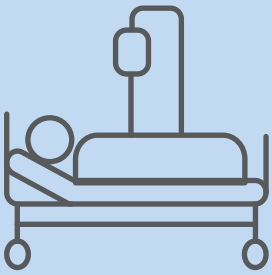
YEAR AT A GLANCE

PATIENT



3,281 patients admitted to a burns unit in 2018/19 is a 6% decrease from the 3,473 in 2017/18

30 years
median age

37%
occured on weekend

67% male

MECHANISM

33%
of adult burns were due to a flame

56%
of paediatric burns were due to a scald

3%
of burns were the result of intentional self-harming

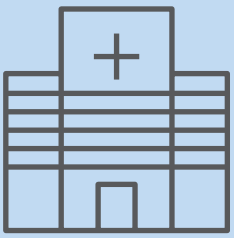
PRE-HOSPITAL MANAGEMENT

29%
of children did not receive the recommended first aid treatment for burn injuries

15%
of children were transported to a BRANZ hospital directly from the scene

19%
of adults were transported to a BRANZ hospital directly from the scene

IN-HOSPITAL OUTCOMES



76%
underwent at least one burn wound management procedure in theatre (consistent with 2017/18 reporting period)

8%
admitted to ICU, a decrease from 9% in 2017/18

59.5 hours
Median ICU stay, a decrease from 65.2 hours in 2017/18

3.8 days
Median hospital stay, consistent with 3.9 days in 2017/18

28 deaths
a decrease from 37 deaths in 2017/18

10%
of patients with a burn exceeding 20% TBSA died, a drop from 14% in 2017/18

ABOUT THIS REPORT

This is the tenth annual report prepared for public release by the Burns Registry of Australia and New Zealand (BRANZ). Data collected during the period of July 1st 2018 to June 30th 2019 from all 17 specialist burns units in Australia and New Zealand are reflected in this report with a particular focus on the profile, treatment, and in-hospital outcomes of burns admissions in the 2018/19 financial year.

Comparisons with previous years are also presented. As data continue to be updated for new and historic patients in the BRANZ, slight differences in case numbers are expected when compared with previous reports. Where appropriate, data has been compared with the American Burn Association's National Burn Repository (NBR) report of data from 2009 to 2018[1].

1 American Burn Association. National Burn Repository 2019 Update: Report of data from 2009-2018. Chicago, IL, USA.

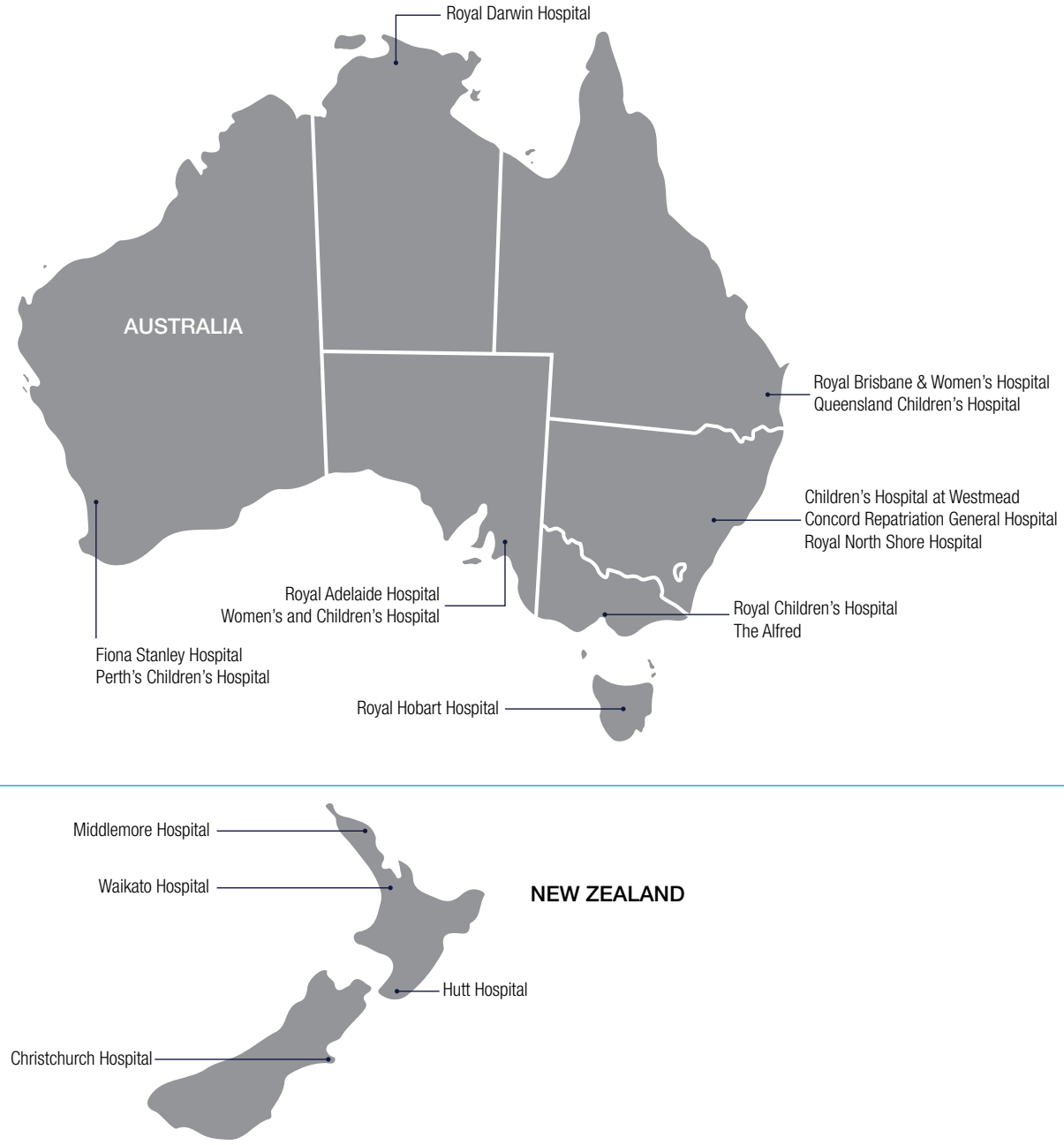
BACKGROUND

OVERVIEW OF THE BURNS REGISTRY OF AUSTRALIA AND NEW ZEALAND

The Burns Registry of Australia and New Zealand (BRANZ) is a clinical quality registry that captures epidemiological, quality of care, and in-hospital outcome data for adult and paediatric burns patients treated in Australian and New Zealand. The Registry is a collaboration between the Australian and New Zealand Burn Association (ANZBA) and Monash University, Department of Epidemiology and Preventive Medicine (DEPM).

Since July 2016, all 17 specialist burns units in Australia and New Zealand have contributed data to the Registry (Figure 1).

FIGURE 1 – Hospitals with Designated Burns Units Across Australia and New Zealand



INCLUSION AND EXCLUSION CRITERIA

The BRANZ captures data about all first admissions to an Australian or New Zealand burns unit within 28 days of injury where a burn is the principal reason for admission and one of the following criteria are met:

- The patient is admitted to hospital for a period of 24 hours or more; OR
- The patient is admitted to hospital for less than 24 hours but requires a burn wound management procedure in theatre; OR
- The patient dies within 24 hours of presentation to the BRANZ hospital.

The Registry also collects data on all readmissions to a designated burns unit that occur within 28 days of discharge from the initial admission.

Desquamating skin conditions such as Stevens-Johnson Syndrome and Toxic Epidermal Necrolysis (TENS) are excluded from the Registry.

DATA METHODOLOGY AND QUALITY ASSURANCE

Data collection is the responsibility of the participating units. Patient data are retrieved from medical records and existing hospital information systems and entered into the web-based database. International Classification of Disease version 10, Australian Modification (ICD-10-AM) diagnostic and procedural codes are predominantly retrieved electronically from hospital information systems, and submitted for uploading to BRANZ.

To ensure all burns data coordinators and collectors designated to collect data for the registry are collecting data in a standardised manner, formal training sessions are held when data collectors commence work. ‘Refresher’ training sessions and ad hoc informal training sessions are available as required.

To maximise data completeness, sites run their own data completeness reports prior to the central extraction of data for the quarterly and annual reports. Manual checking of data occurs at each reporting deadline, and quality assurance review and checks for reliability and validity are planned to ensure BRANZ produces high quality data. Completeness of data by site is also provided in the quarterly reports to enable individual sites to track their data completeness relative to other participating sites.

PATIENT DEMOGRAPHICS

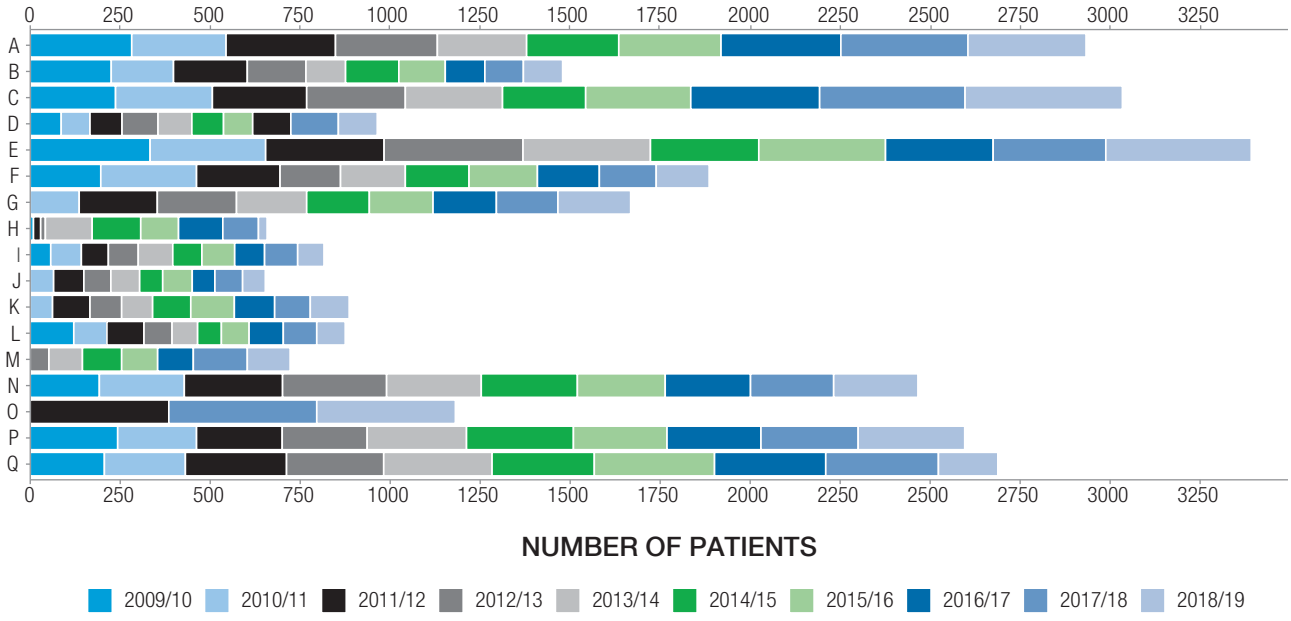
BURNS PATIENT NUMBERS IN BRANZ

The number of patients registered by the BRANZ during each reporting period from July 2009 to June 2019, along with the number of sites contributing data to the registry and the relative percentage change from the previous year, are reported in Table 1. An upward trend in the number of patients registered each year was observed from July 2009 to June 2012 as more units began contributing to the registry. The number of patients remained relatively stable from July 2012 to June 2015, before another upward trend occurred as the final designated burns unit began contributing data. There was a decrease in the number of registered patients during the 2018/19 reporting period; this may be explained by one site not submitting data in 2019. The number of patients admitted to each hospital from July 2009 to June 2019 are presented in Figure 2.

TABLE 1 – Number of Registered BRANZ Patients by Reporting Period, 2009/10 to 2018/19

	CONTRIBUTING SITES	NUMBER OF REGISTERED PATIENTS	RELATIVE CHANGE TO PREVIOUS REPORTING PERIOD
2009/10	12	2,189	
2010/11	15	2,491	13.8%
2011/12	15	2,816	13%
2012/13	16	2,778	-1.3%
2013/14	16	2,847	2.5%
2014/15	16	2,784	-2.2%
2015/16	16	2,920	4.9%
2016/17	17	3,321	13.7%
2017/18	17	3,473	4.6%
2018/19	17	3,281	-5.5%

FIGURE 2 – Number of Registered BRANZ Patients by Site and Reporting Period, 2009/10 to 2018/19



AGE AND GENDER PROFILE OF PATIENTS REGISTERED BY BRANZ

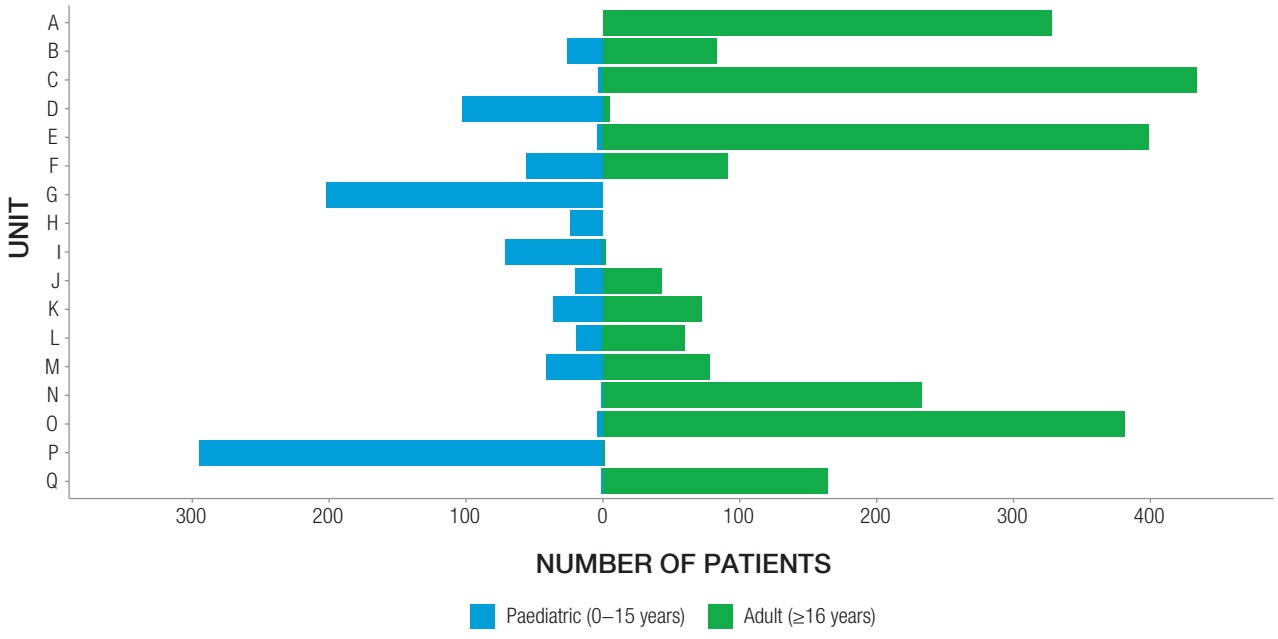
Within BRANZ, age at the time of burn injury is calculated using the date of birth and the date of injury. Patients are classified as either paediatric patients (15 years of age and under) or adult patients (16 years of age and older) based on their age at the time of burn injury. The proportion of paediatric patients registered by the BRANZ increased from July 2009 to June 2015, before declining from July 2015 to the end of the current reporting period (Table 2). The average age of registered patients from July 2009 to June 2019 was 30.1 years (standard deviation [SD] = 23.2). In 2018/19, the average age of BRANZ patients was 32.3 (SD = 23.4). This age has been increasing since July 2014.

TABLE 2 – Demographic Profile of Registered BRANZ Patients, 2009/10 to 2018/19

	TOTAL (N)	PAEDIATRIC PATIENTS	ADULT PATIENTS	PAEDIATRIC AGE MEAN (SD)	ADULT AGE MEAN (SD)
2009/10	2,189	590 (27.0%)	1,599 (73.1%)	3.8 (4.4)	40.5 (18.2)
2010/11	2,491	765 (30.7%)	1,726 (69.3%)	4.3 (4.6)	39.5 (17.9)
2011/12	2,816	894 (31.8%)	1,922 (68.3%)	4.3 (4.5)	41.5 (18.6)
2012/13	2,778	975 (31.5%)	1,903 (68.5%)	4.4 (4.5)	41.1 (18.3)
2013/14	2,847	1,024 (36.0%)	1,823 (64.0%)	4.2 (4.4)	41.6 (18.0)
2014/15	2,784	1,026 (36.9%)	1,758 (63.2%)	4.3 (4.5)	42.6 (18.4)
2015/16	2,920	966 (33.1%)	1,952 (66.9%)	4.3 (4.4)	41.8 (18.1)
2016/17	3,321	993 (29.9%)	2,327 (70.1%)	4.2 (4.5)	42.6 (18.7)
2017/18	3,473	998 (28.8%)	2,470 (71.2%)	4.3 (4.5)	42.8 (18.2)
2018/19	3,281	906 (27.6%)	2,374 (72.4%)	4.2 (4.4)	42.9 (18.3)
TOTAL	**28,900**	**9,037 (31.3%)**	**19,854 (68.7%)**	**4.2 (4.5)**	**41.8 (18.3)**

Age data was missing for one patient registered by the BRANZ during the 2018/19 reporting period. Of the 3,280 patients with age data, 906 were paediatric patients and 2,374 were adult patients. The number of paediatric and adult patients admitted to each designated burns unit during the 2018/19 reporting period are presented in Figure 3.

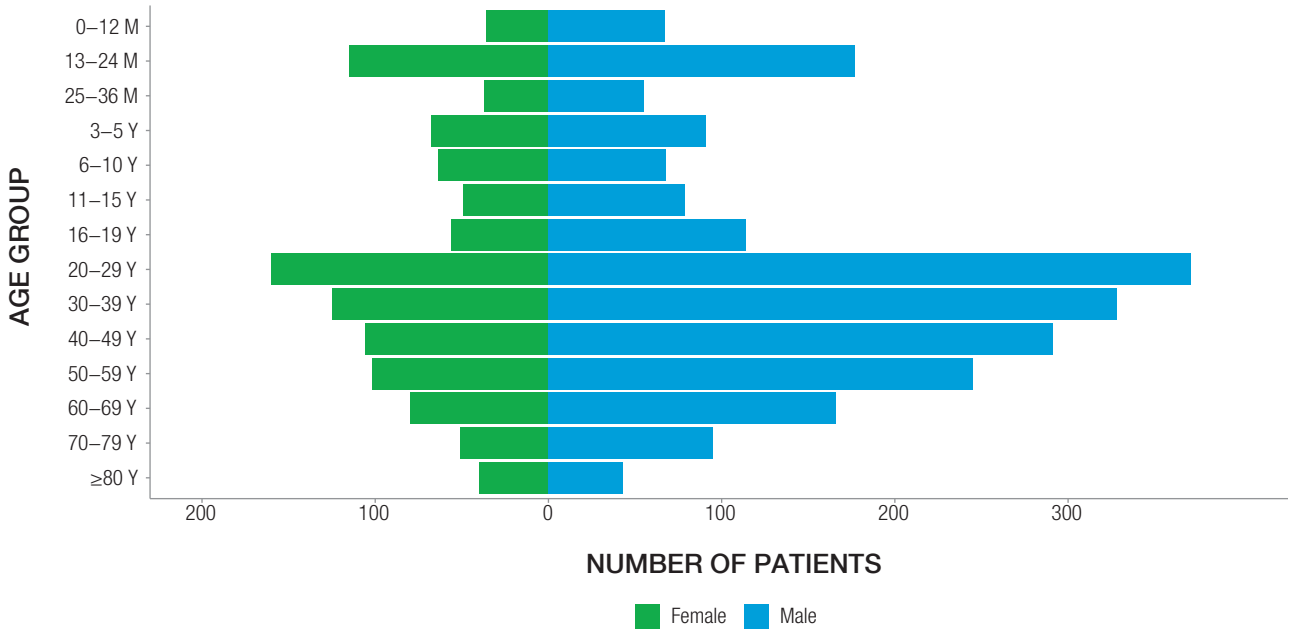
FIGURE 3 – Number of Paediatric and Adult Registered BRANZ Patients by Site, 2018/19



Sixty-eight percent of patients registered in the BRANZ are male. The gender distribution of patients has remained consistent over the past ten years, regardless of the number of sites contributing to the registry.

Figure 4 shows the distribution of patients by gender for BRANZ registered patients from July 2018 to June 2019. Two thirds of all cases were males, and males represented the majority of cases in all age groups. Thirty-two percent of all paediatric cases were aged one to two years, while 22% of all adult cases were aged 20 to 29 years. These findings are consistent with previous BRANZ reporting periods. These figures are also consistent with data from the NBR, where males are more predominant than females and the adult burn incidence declines with age[2].

FIGURE 4 – Number of Registered BRANZ Patients by Age Group and Gender, 2018/19

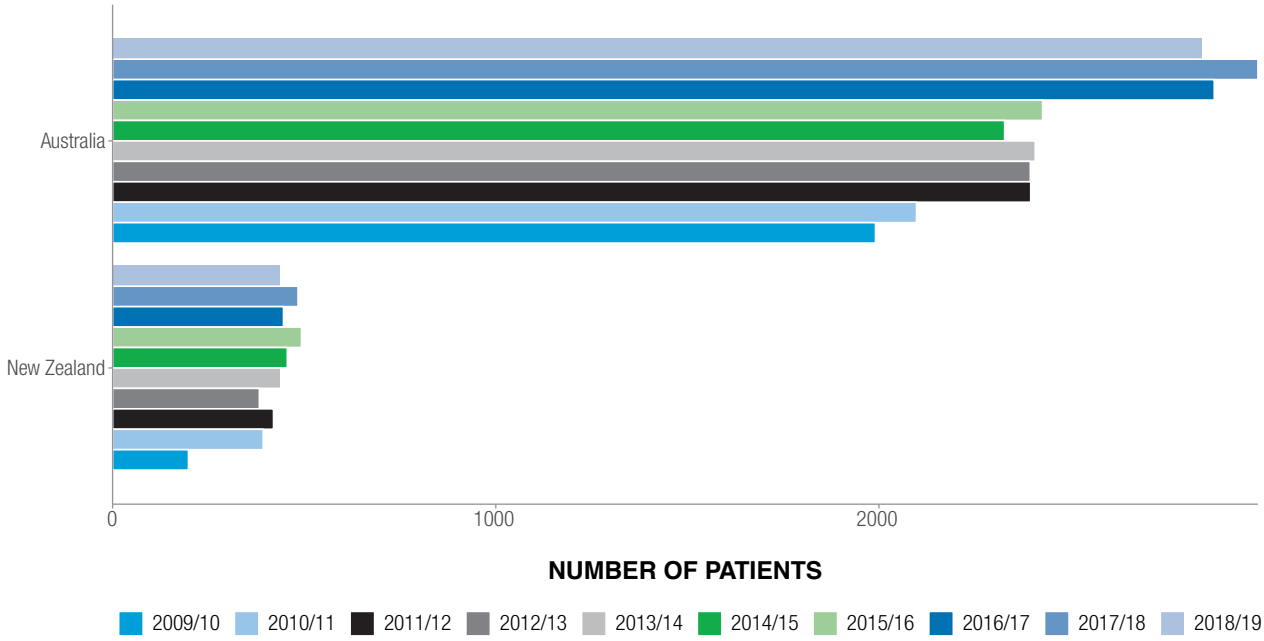


2 American Burn Association. National Burn Repository 2019 Update: Report of data from 2009-2018. Chicago, IL, USA.

BURN PATIENT ADMISSIONS IN BRANZ BY COUNTRY

In 2018/19, 2,844 patients (87%) were registered by Australian burn units and 437 patients (13%) were registered by New Zealand burn units. The distribution of registered patients by country has remained relatively stable since June 2016.

FIGURE 5 – Number of Registered BRANZ Patients by Country and Reporting Period, 2009/10 to 2018/19



ETHNICITY DISTRIBUTION OF PATIENTS REGISTERED BY BRANZ

Australian hospitals routinely collect the patients' country of birth, whereas New Zealand hospitals record patient ethnicity. Within the BRANZ, ethnicity is defined as the ethnic group, or groups, which a person identifies with or feels they belong to. Ethnicity is a measure of cultural affiliation, as opposed to race, nationality, or citizenship. Therefore, the data are reported separately for the New Zealand and Australian burn centres.

Region of birth data were missing for 33 Australian cases during the 2018/19 reporting period. Where the region of birth data was complete, the majority of cases admitted to Australian burns units were born in Australia (Table 3).

TABLE 3 – Region of Birth Data for Australian Burns Unit Patients, 2018/19

REGION OF BIRTH	N (%)
Australian Peoples	2,254 (80.2%)
North-West European	125 (4.5%)
Southern and Central Asian	72 (2.6%)
Southern and Eastern European	71 (2.5%)
New Zealand Peoples	68 (2.4%)
South-East Asian	66 (2.4%)
North-East Asian	47 (1.7%)
North African and Middle Eastern	40 (1.4%)
People of the Americas	29 (1.0%)
Sub-Saharan African	29 (1.0%)
Oceanian (other)	10 (<1%)

Australian sites also collect data to identify whether the patient is of Aboriginal, South Sea Islander, or Torres Strait Islander descent (i.e., indigenous to Australia). Patients are deemed to be an Australian Aboriginal if they are indigenous to the Australian continent, identify as Aboriginal, and are accepted as such by the community which they are associated with. A similar definition is used for patients of Torres Strait Islander descent, should they be indigenous to the Torres Strait Islands between Cape York and New Guinea.

Indigenous status data were missing for 10 registered Australian patients during the 2018/19 reporting period. Where the Indigenous status data were complete, less than 10% of cases identified as Indigenous. There was a noticeable jump in the number of Indigenous patients registered in the BRANZ after the 2009/10 reporting period. However, this number has remained consistent since this initial increase. The reason for this initial increase is unknown.

FIGURE 6 – Number of Australian Registered BRANZ Patients by Indigenous Status and Reporting Period, 2009/10 to 2018/19

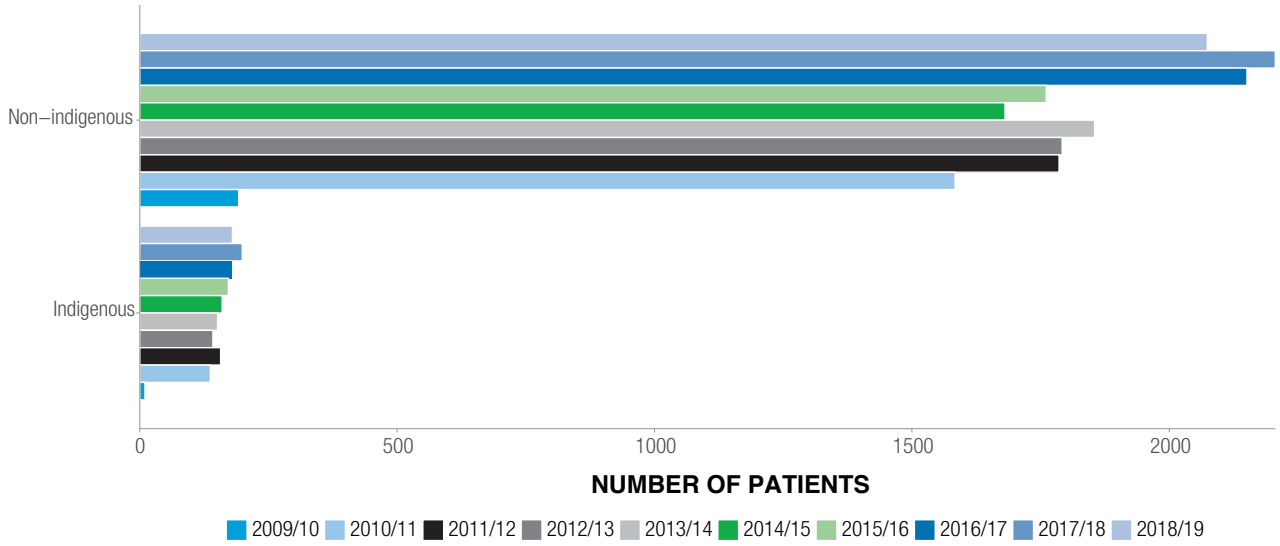


Table 4 displays the rate of burn injury resulting in a burns unit admission per 100,000 people for Indigenous and non-Indigenous individuals during the 2018/19 reporting period. The rate of admission to Australian burns units for the Indigenous population is more than double that of the non-Indigenous population. The increased rate of burn injuries in the Indigenous Australian population is consistent with previous Annual Reports.

TABLE 4 – Rate of Burn Injury per 100,000 People by Indigenous Status, 2018/19

Non-Indigenous	Indigenous	Total
8.9	22.5	9.1

Estimated resident population data obtained from the Australian Bureau of Statistics[3].

Ethnicity data were missing for 70 New Zealand cases during the 2018/19 reporting period. Where data were complete, the majority of cases admitted to New Zealand burns units were New Zealanders not of Maori descent (Table 5). A further 32% of cases were New Zealand Maori. These two ethnic groups have accounted for approximately 80% of cases admitted to New Zealand burns units since the launch of the registry in 2009.

TABLE 5 – Ethnicity Data for New Zealand Burns Unit Patients, 2018/19

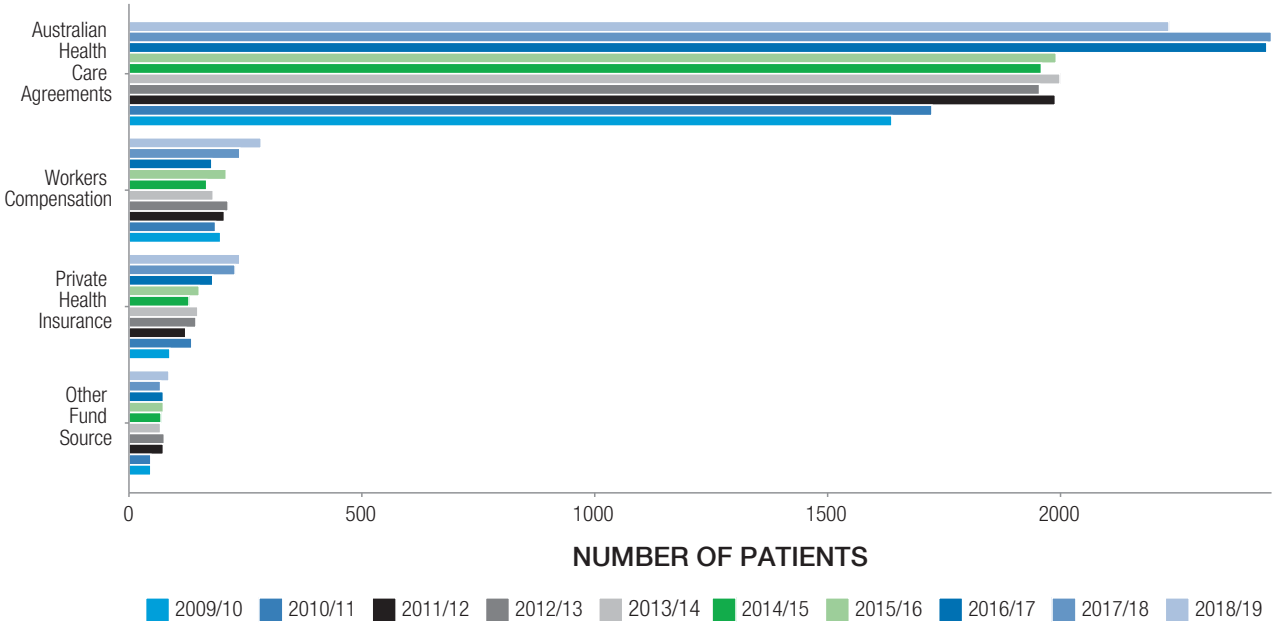
ETHNICITY	N (%)
New Zealander	204 (55.6%)
New Zealand Maori	116 (31.6%)
Samoan	12 (3.3%)
Other Pacific Island	11 (3.0%)
Australian	10 (2.7%)
Tongan	8 (2.2%)
Cook Island Maori	6 (1.6%)

3 https://www.abs.gov.au/ausstats/abs@.nsf/mf/3238.0.55.001

FUNDING PROFILE OF PATIENTS REGISTERED BY BRANZ

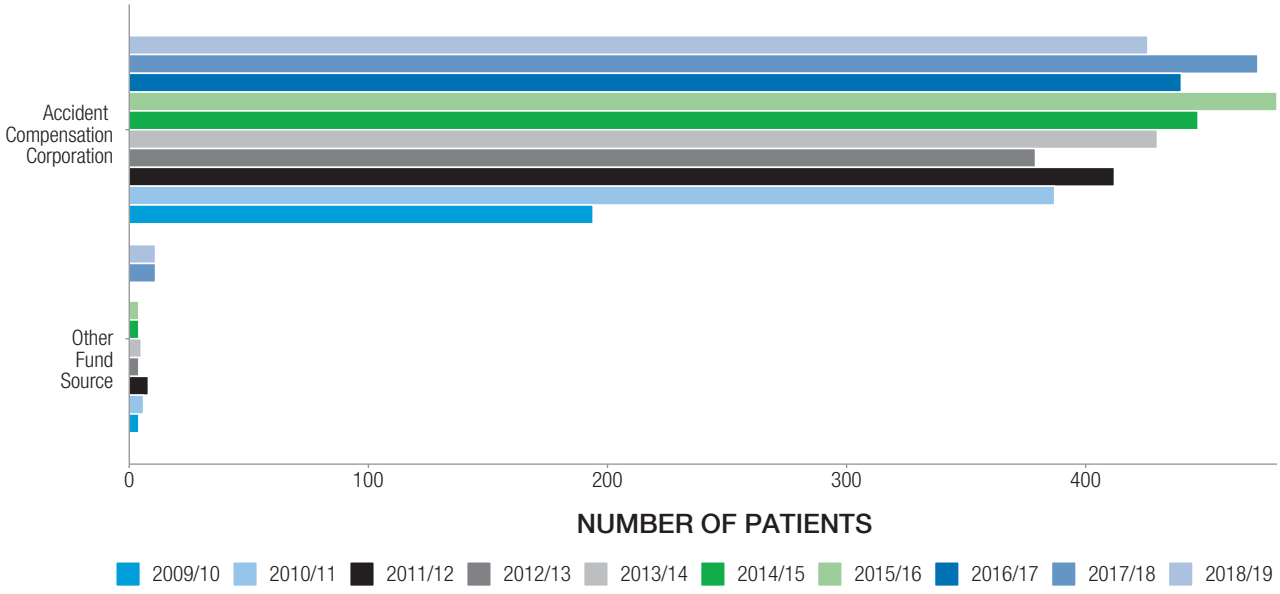
Most cases admitted to Australian burns units were funded by the Australian Health Care Agreement (n = 2,233, 78.6%). A further 10% of the admissions to Australian burns units (n = 284) were covered under the relevant workers compensation scheme in each state or territory and eight percent of the admissions to Australian burns units (n = 238) were funded through various private health insurance schemes. Examples of other sources of funding in cases admitted to Australian burns units were third party motor vehicle insurance, the Department of Veterans Affairs, the Department of Defence, and reciprocal health care agreements. The Australian Health Care Agreement has been the predominant funding source over the duration of the registry. The number of patients with private health insurance has increased steadily, which may reflect changes in hospital policy.

FIGURE 7 – Fund Source for BRANZ Registered Australian Patients by Reporting Period, 2009/10 to 2018/19



Ninety-eight percent of cases admitted to New Zealand burns units were funded by the Accident Compensation Corporation (n = 426) which is the comprehensive, no-fault personal injury insurance scheme for all New Zealand residents and visitors to the country. Other sources of funding of cases admitted to New Zealand burns units were the Ministry of Health, Surgical Services Contract, and private health insurers. Almost, if not all, patients presenting to New Zealand burns units since July 2009 have been funded by the Accident Compensation Corporation.

FIGURE 8 – Fund Source for BRANZ Registered New Zealand Patients by Reporting Period, 2009/10 to 2018/19



GEOGRAPHIC PROFILE OF PATIENTS REGISTERED BY BRANZ (AUSTRALIAN SITES ONLY)

Consistent with previous years, over half (59%) of burns admissions to Australian units occurred in major cities according to the Australian Bureau of Statistics Classification of Remoteness[4]. A further 35% occurred in regional Australia, and six percent in remote areas.

TABLE 6 – Remoteness Profile for BRANZ Registered Australian Patients by Rreporting Pperiod, 2009/10 to 2018/19

	MAJOR CITIES OF AUSTRALIA N (%)	INNER REGIONAL AUSTRALIA N (%)	OUTER REGIONAL AUSTRALIA N (%)	REMOTE AUSTRALIA N (%)	VERY REMOTE AUSTRALIA N (%)
2009/10	915 (55.1%)	355 (21.4%)	301 (18.1%)	65 (3.9%)	25 (1.5%)
2010/11	1,091 (58.3%)	361 (19.3%)	317 (16.9%)	57 (3.0%)	45 (2.4%)
2011/12	1,244 (55.8%)	413 (18.5%)	389 (17.5%)	134 (6.0%)	49 (2.2%)
2012/13	1,284 (58.2%)	447 (20.3%)	342 (15.5%)	93 (4.2%)	41 (1.9%)
2013/14	1,333 (60.2%)	437 (19.7%)	316 (14.3%)	82 (3.7%)	46 (2.1%)
2014/15	1,230 (58.8%)	431 (20.6%)	317 (15.2%)	70 (3.3%)	44 (2.1%)
2015/16	1,250 (60.0%)	453 (21.7%)	268 (12.9%)	79 (3.8%)	34 (1.6%)
2016/17	1,525 (57.9%)	592 (22.5%)	380 (14.4%)	95 (3.6%)	41 (1.6%)
2017/18	1,583 (59.2%)	591 (22.1%)	343 (12.8%)	107 (4.0%)	48 (1.8%)
2018/19	1,464 (58.2%)	530 (21.1%)	375 (14.9%)	92 (3.7%)	55 (2.2%)
TOTAL	**12,919 (58.2%)**	**4,610 (20.8%)**	**3,348 (15.1%)**	**874 (3.9%)**	**428 (1.9%)**

Compared to major Australian cities, the rate of burn injury per 100,000 people is higher in regional and remote areas. The rate of burn injury was higher in Indigenous people for each remoteness region, with the exception of very remote Australia.

TABLE 7 – Rate of Burn Injury per 100,000 People by Remoteness Area, 2018/19

REGION	INDIGENOUS	NON-INDIGENOUS	COMBINED
Major Cities of Australia	15.7	7.2	8.3
Inner Regional Australia	14.1	12.2	12.1
Outer Regional Australia	38.3	17.5	18.3
Remote Australia	77.1	26.0	31.5
Very Remote Australia	21.4	38.7	27.4
TOTAL	**24.3**	**9.3**	**10.3**

Estimated resident population data obtained from the Australian Bureau of Statistics[5]

4 Australian Bureau of Statistics. 1216.0 - Australian Standard Geographical Classification. 2005.

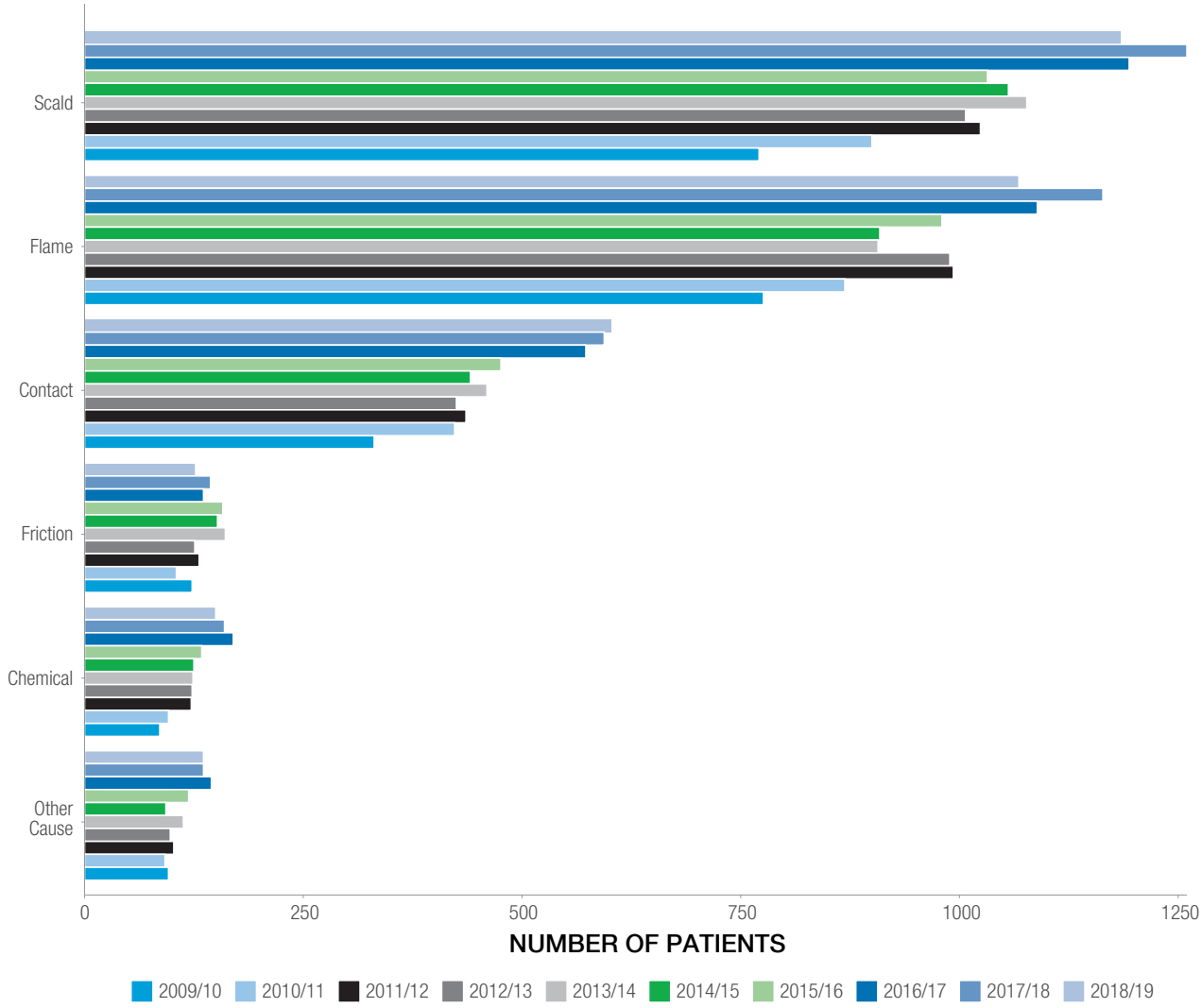
5 https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3218.02016/17?OpenDocument and https://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/2075.0Main%20Features202016?opendocument&tabname=Summary&prodno=2075.0&issue=2016&num=&view=

BURN INJURY EVENT DATA

CAUSE OF INJURY

In 2018/19, most patients sustained a scald (36%; Figure 9). The top three causes of burn injury (scalds, flame burns, and contact burns) accounted for 87% of all injuries. Recent data from the American Burn Association's National Burn Repository also identified scalds and flame burns as the most common aetiology, accounting for 72% of burns between them[6]. "Other" causes of burn injuries include radiant heat, electrical burns, and burns due to pressurised air or gas.

FIGURE 9 – Primary Cause of Injury in Registered BRANZ Patients by Reporting Period, 2009/10 to 2018/19



6 American Burn Association. National Burn Repository 2019 Update: Report of data from 2009-2018. Chicago, IL, USA.

The most common cause of burn injury amongst paediatric patients was scalds (56%), followed by contact (23%) and flame burns (9%). This distribution has remained consistent from July 2009 to June 2019 (Table 8). The most common cause of burn injury in adult patients were flame burns (43%), followed by scalds (27%), and contact burns (16%). This distribution has remained consistent from July 2009 to June 2019 (Table 8). The most common cause of burn injury in older adult patients were scalds (37%), followed by flame (33%) and contact burns (21%). This distribution has remained consistent from July 2009 to June 2019 (Table 8).

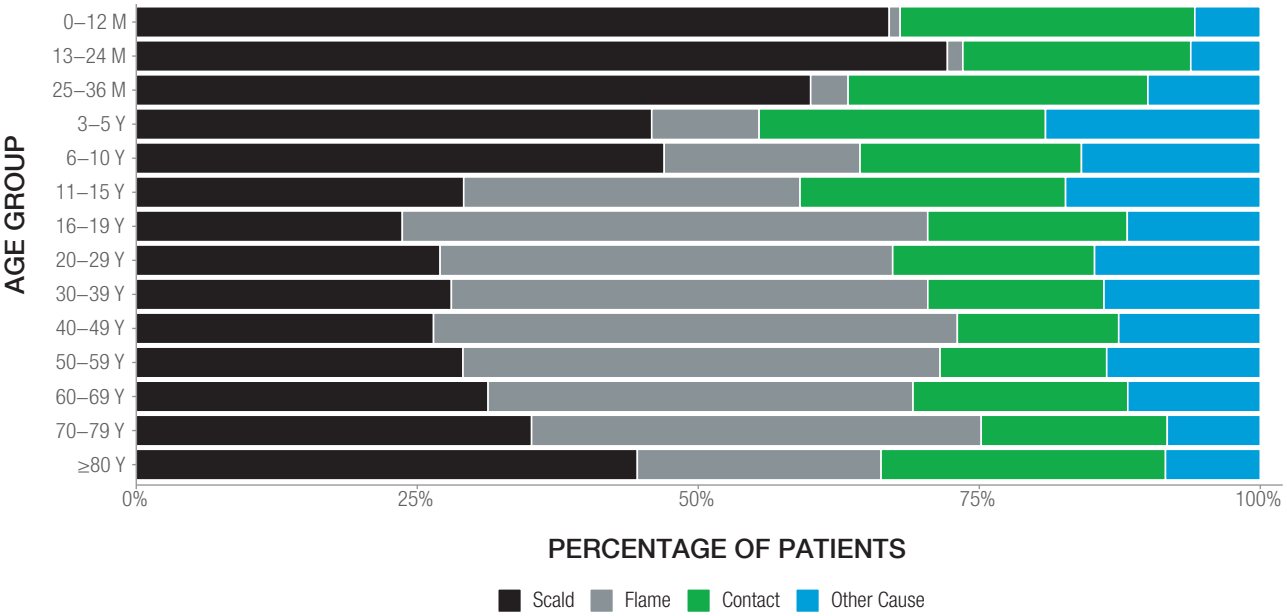
TABLE 8 – Primary Cause of Burn Injury in Registered BRANZ Patients by Reporting Period and Age, 2009/10 to 2018/19

	CONTACT BURN	SCALD	FLAME BURN	OTHER CAUSE
Paediatric Patients (0-15 Years)				
2009/10	124 (21.1%)	330 (56.1%)	75 (12.8%)	59 (10.0%)
2010/11	165 (21.6%)	415 (54.3%)	110 (14.4%)	74 (9.7%)
2011/12	192 (21.6%)	475 (53.3%)	124 (13.9%)	100 (11.2%)
2012/13	193 (22.2%)	476 (54.7%)	116 (13.3%)	86 (9.9%)
2013/14	202 (19.8%)	583 (57.0%)	115 (11.2%)	123 (12.0%)
2014/15	217 (21.2%)	564 (55.1%)	110 (10.7%)	133 (13.0%)
2015/16	209 (21.8%)	508 (53.1%)	111 (11.6%)	129 (13.5%)
2016/17	227 (22.9%)	569 (57.5%)	97 (9.8%)	97 (9.8%)
2017/18	223 (22.4%)	560 (56.2%)	95 (9.5%)	118 (11.9%)
2018/19	206 (22.9%)	504 (56.0%)	84 (9.3%)	106 (11.8%)
TOTAL	**1,958 (21.8%)**	**4,984 (55.4%)**	**1,037 (11.5%)**	**1,025 (11.4%)**
Adult Patients (16-64 Years)				
2009/10	181 (12.8%)	363 (25.7%)	644 (45.5%)	227 (16.0%)
2010/11	229 (14.9%)	409 (26.6%)	703 (45.7%)	197 (12.8%)
2011/12	213 (12.8%)	437 (26.2%)	785 (47.0%)	234 (14.0%)
2012/13	204 (12.3%)	431 (26.0%)	785 (47.4%)	238 (14.4%)
2013/14	218 (13.8%)	403 (25.5%)	713 (45.0%)	249 (15.7%)
2014/15	194 (12.8%)	393 (25.9%)	713 (46.9%)	220 (14.5%)
2015/16	243 (14.4%)	415 (24.6%)	780 (46.2%)	251 (14.9%)
2016/17	293 (14.8%)	503 (25.4%)	872 (44.0%)	315 (15.9%)
2017/18	319 (15.0%)	549 (25.8%)	959 (45.1%)	300 (14.1%)
2018/19	326 (16.1%)	556 (27.4%)	872 (43.0%)	276 (13.6%)
TOTAL	**2,420 (14.1%)**	**4,459 (25.9%)**	**7,826 (45.5%)**	**2,507 (14.5%)**
Older Adult Patients (≥65 Years)				
2009/10	26 (14.4%)	78 (43.3%)	57 (31.7%)	19 (10.6%)
2010/11	29 (15.9%)	76 (41.5%)	56 (30.6%)	22 (12.0%)
2011/12	31 (12.5%)	112 (45.2%)	84 (33.9%)	21 (8.5%)
2012/13	28 (11.7%)	100 (41.8%)	88 (36.8%)	23 (9.6%)
2013/14	40 (17.0%)	91 (38.6%)	79 (33.5%)	26 (11.0%)
2014/15	30 (12.9%)	99 (42.7%)	86 (37.1%)	17 (7.3%)
2015/16	24 (9.6%)	109 (43.4%)	87 (34.7%)	13 (12.4%)
2016/17	52 (15.6%)	122 (36.6%)	120 (36.0%)	39 (11.7%)
2017/18	48 (14.6%)	150 (45.5%)	110 (33.3%)	22 (6.7%)
2018/19	70 (20.8%)	124 (36.9%)	112 (33.3%)	30 (8.9%)
TOTAL	**378 (14.7%)**	**1,061 (41.3%)**	**879 (34.2%)**	**250 (9.8%)**

Data expressed as number (percentages).

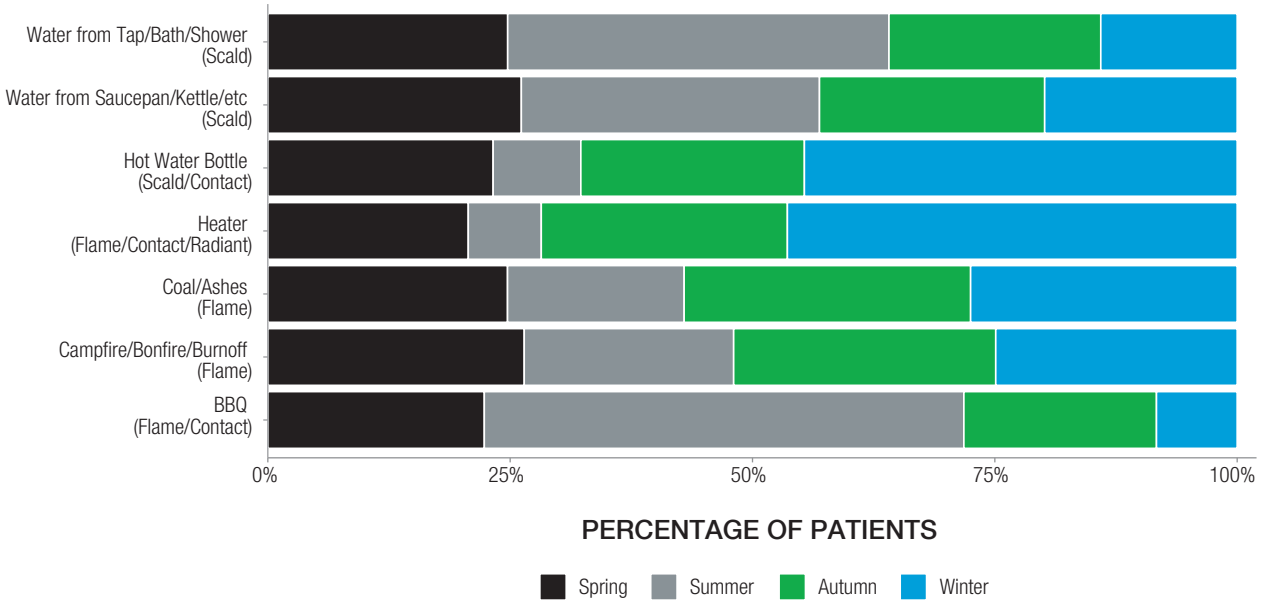
The change in the distribution of the primary cause of burn injury is perhaps best visualised by Figure 10. Scalds account for the majority of burns in children under the age of three years, at which point there is an increase in flame burns. It is not until the age of 50 when there is an upward trend in the proportion of scalds and a decline in the proportion of flame burns.

FIGURE 10 – Primary Cause of Injury for Registered BRANZ Patients by Age Group, 2018/19



Examining the impact of the changing seasons on burn cause can help guide burns prevention strategies and resource utilisation. Whether the burn occurred during summer, autumn, winter, or spring months was determined using the date of injury. Since the launch of the registry, patterns of seasonal variations were mainly observed in relation to burn injuries caused by heaters, hot water bottles, and barbeques. That is, a greater number of burns caused by heaters and hot water bottles have occurred in the winter months, while a greater number of burns involving barbeques occur in the summer months. In contrast, there are some injury causes that do not display seasonal variation. For example, scalds by water from a saucepan, bottle, or similar occur in similar numbers regardless of the season.

FIGURE 11 – Seasonal Trends in Burn Injury Cause for Registered BRANZ Patients, 2009/10 to 2018/19



The ten most common sub-causes of burn injuries, by age group, are shown in Table 9. These accounted for 80% of paediatric cases, 55% of adult cases, and 58% of older adult cases. In paediatric cases, scalds involving hot beverages were the most common cause of injury, followed by scalds involving water from a saucepan, kettle, jug, billy, or urn. In adult cases a flame burn from a campfire, bonfire, or burn-off was the most common cause of injury, followed by scalds from fat and oil. In older adult cases scalds involving water from a saucepan, kettle, jug, billy, or urn were the most common cause of injury.

TABLE 9 – Primary Sub-Cause of Burn Injury in Registered BRANZ Patients by Age, 2018/19

CAUSE	SUB-CAUSE	N (%)
	Paediatric Patients (0-15 Years)	
Scald	Hot Beverages	172 (19.4%)
Scald	Water from Saucepan/Kettle/Jug/Billy/Urn	137 (15.4%)
Scald	Food (Liquid/Solid)	91 (10.3%)
Contact	Coals/Ashes	65 (7.3%)
Friction	Treadmill	37 (4.2%)
Contact	Vehicle Exhaust	36 (4.1%)
Flame	Campfire/Bonfire/Burn-Off	31 (3.5%)
Scald	Water from Tap/Bath/Shower	26 (2.9%)
Scald	Fat/Oil	24 (2.7%)
Contact	Iron	20 (2.3%)
	Adult Patients (16-64 Years)	
Flame	Campfire/Bonfire/Burn-Off	260 (13.0%)
Scald	Fat/Oil	179 (8.9%)
Flame	Other Source	126 (6.3%)
Scald	Water from Saucepan/Kettle/Jug/Billy/Urn	101 (5.0%)
Chemical	Alkali Substance	91 (4.5%)
Flame	Vehicle/Engine Parts	84 (4.2%)
Contact	Coals/Ashes	73 (3.6%)
Flame	Gas/Gas Bottle	68 (3.4%)
Scald	Food (Liquid/Solid)	66 (3.3%)
	Older Adult Patients (≥65 Years)	
Scald	Water from Saucepan/Kettle/Jug/Billy/Urn	26 (7.9%)
Flame	Other Source	24 (7.3%)
Flame	Campfire/Bonfire/Burn-Off	23 (7.0%)
Scald	Hot Beverages	22 (6.7%)
Scald	Water from Tap/Bath/Shower	20 (6.1%)
Scald	Fat/Oil	18 (5.5%)
Contact	Hot Ground	17 (5.2%)
Flame	Welder/Grinder	16 (4.9%)
Scald	Food (Liquid/Solid)	12 (3.6%)
Scald	Water from Hot Water Bottle	12 (3.6%)

ACCELERANT USE (FLAME INJURIES ONLY)

An accelerant was used to ignite or enhance the flame in 57% of flame burn cases during the 2018/19 reporting period. The proportion of flame burns involving an accelerant has remained between approximately 55% and 65% since the development of the registry. Petrol has been the most common accelerant used (Table 10).

FIGURE 12 – Accelerant Involvement in Flame Burns by Reporting Period, 2009/10 to 2018/19

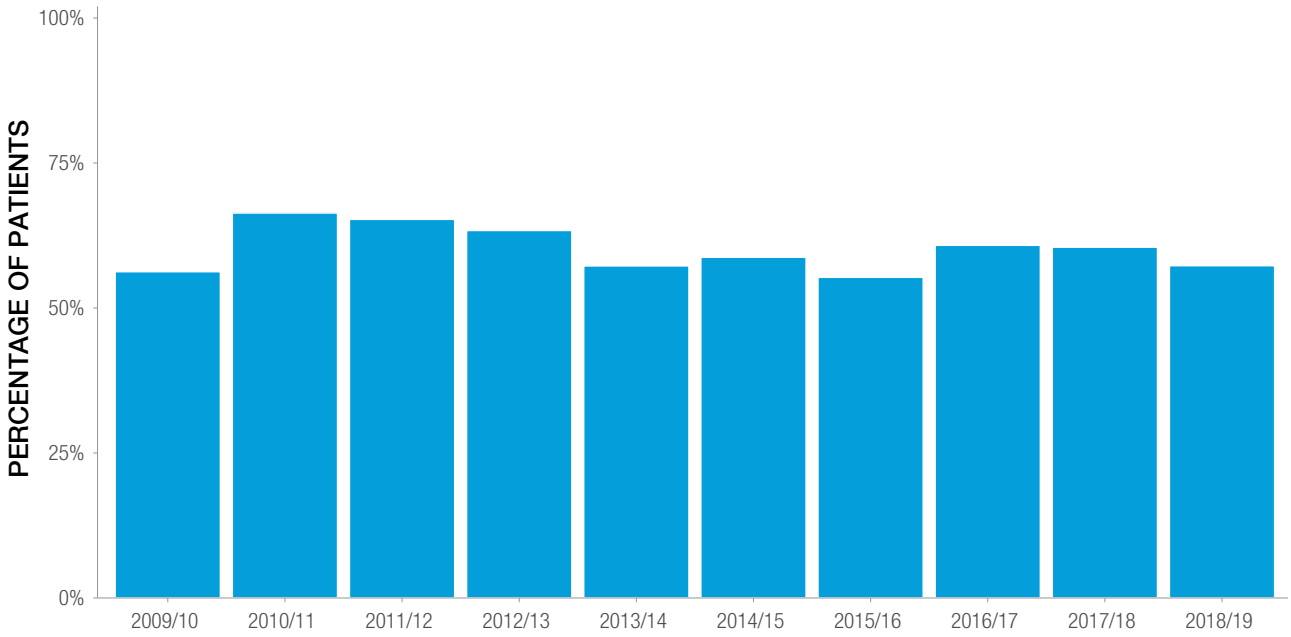


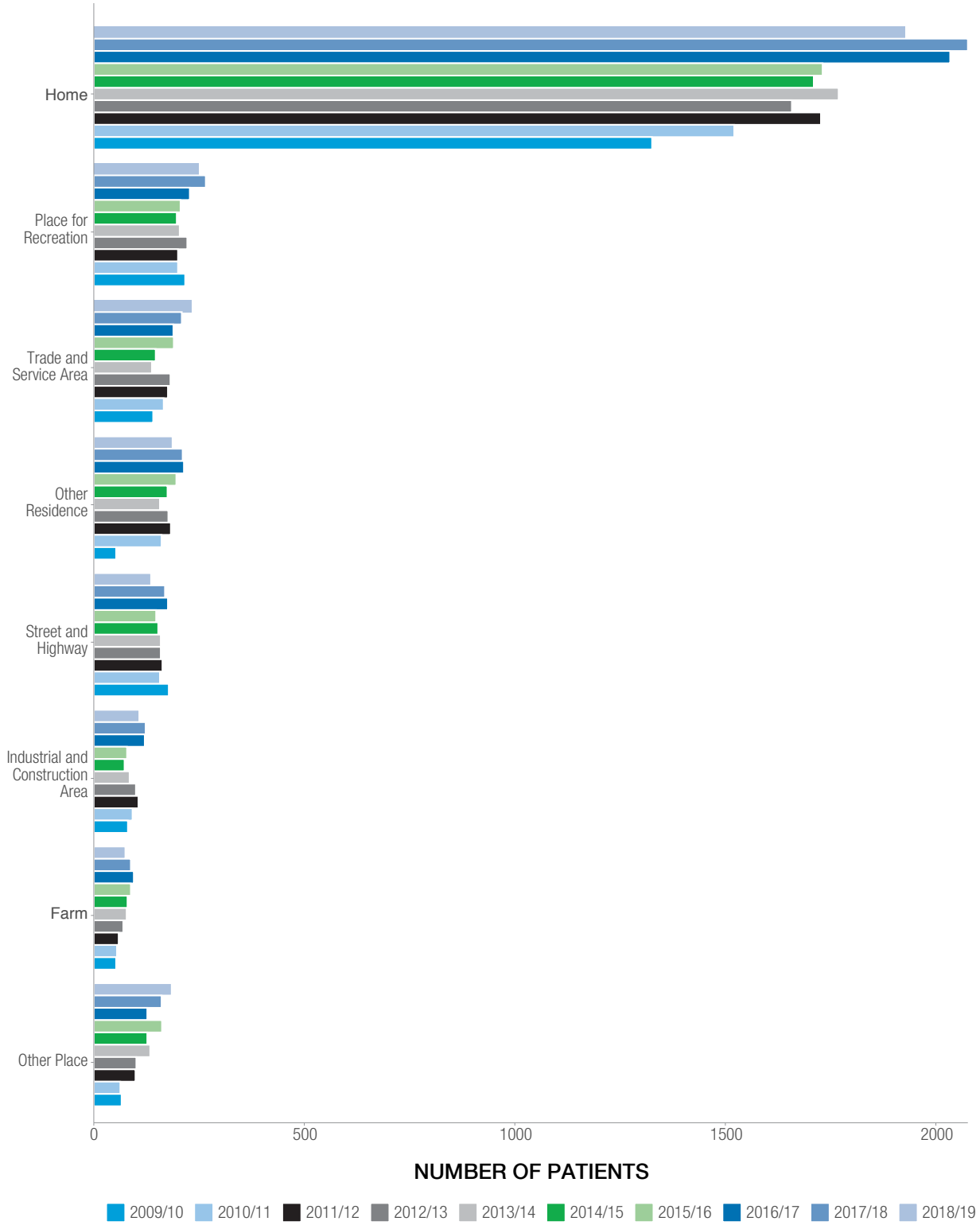
TABLE 10 – Accelerant Type in Flame Burns, 2009/10 to 2018/19

ACCELERANT	N (%)
Petrol	2,945 (53.0%)
Methylated Spirits	608 (11.0%)
Aerosol Can	318 (5.7%)
Other Gas	194 (3.5%)
Kerosene	123 (2.2%)
Paint Stripper	37 (0.7%)
Turpentine	30 (0.5%)
Aviation Gas	23 (0.4%)
Other (Specify)	1,275 (23.0%)

PLACE OF INJURY

The place of injury for all cases registered during the 2018/19 reporting period are presented in Figure 13. More than 60% of burn injuries occurred in the home, consistent with previous reporting periods.

FIGURE 13 – Place of Injury for Registered BRANZ Patients by Reporting Period, 2018/19



For burns that occurred in the home, most paediatric and adult burns occurred in the kitchen (Table 11). The second most common area for paediatric burns was the living room, playroom, or family room. For adults, it was the garden or yard. This distribution may reflect the differences in the primary cause of the burn injury between paediatric and adult patients.

TABLE 11 – Five Most Common Places Where Burn Injury Occurred in the Home by Adult Status, 2009/10 to 2018/19

PLACE	N (%)
Paediatric Patients (0-15 Years)	
Kitchen	3,103 (45.9%)
Living Room, Playroom, or Family Room	1,235 (18.3%)
Garden/Yard	830 (12.3%)
Unspecified Part of Building or Grounds	528 (7.8%)
Bathroom or Toilet	444 (6.6%)
Adult Patients (≥16 Years)	
Kitchen	3,432 (32.0%)
Garden/Yard	2,672 (24.9%)
Unspecified Part of Building or Grounds	1,273 (11.9%)
Living Room, Playroom, or Family Room	1,113 (10.4%)
Bedroom	693 (6.5%)

ACTIVITY AT TIME OF INJURY

The five most common activities resulting in burn injuries for each age group during the 2018/19 reporting period are presented in Table 12. Cooking, or being near a person cooking, was a common activity for all three age groups. The activity at time of injury has remained reasonably consistent over time for patients of all ages.

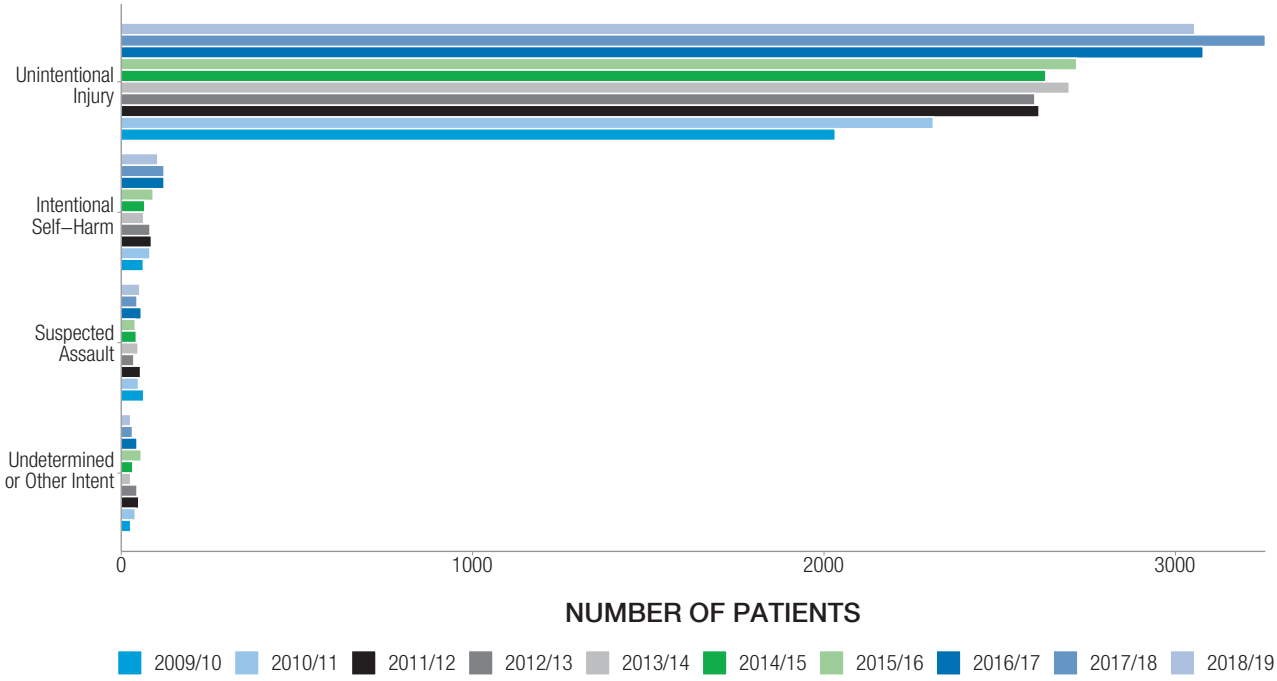
TABLE 12 – Top Five Activities at Time of Injury for Registered BRANZ Patients by Age Group, 2018/19

ACTIVITY	N (%)
Paediatric Patients (0-15 Years)	
Near Person Cooking	299 (34.7%)
Playing	217 (25.5%)
Leisure Activity (Excluding Sports Activity)	119 (13.8%)
Cooking	38 (4.4%)
Other Specified Activity	38 (4.4%)
Adult Patients (16-64 Years)	
Leisure Activity (Excluding Sports Activity)	415 (21.0%)
Cooking	387 (19.6%)
Working for Income	364 (18.5%)
Sleeping/Resting	106 (5.4%)
Other Specified Activity	95 (4.8%)
Older Adult Patients (≥65 Years)	
Cooking	75 (23.5%)
Sleeping/Resting	40 (12.5%)
Leisure Activity (Excluding Sports Activity)	25 (7.8%)
Other Vital Activities	25 (7.8%)
Household Maintenance	24 (7.5%)

INJURY INTENT

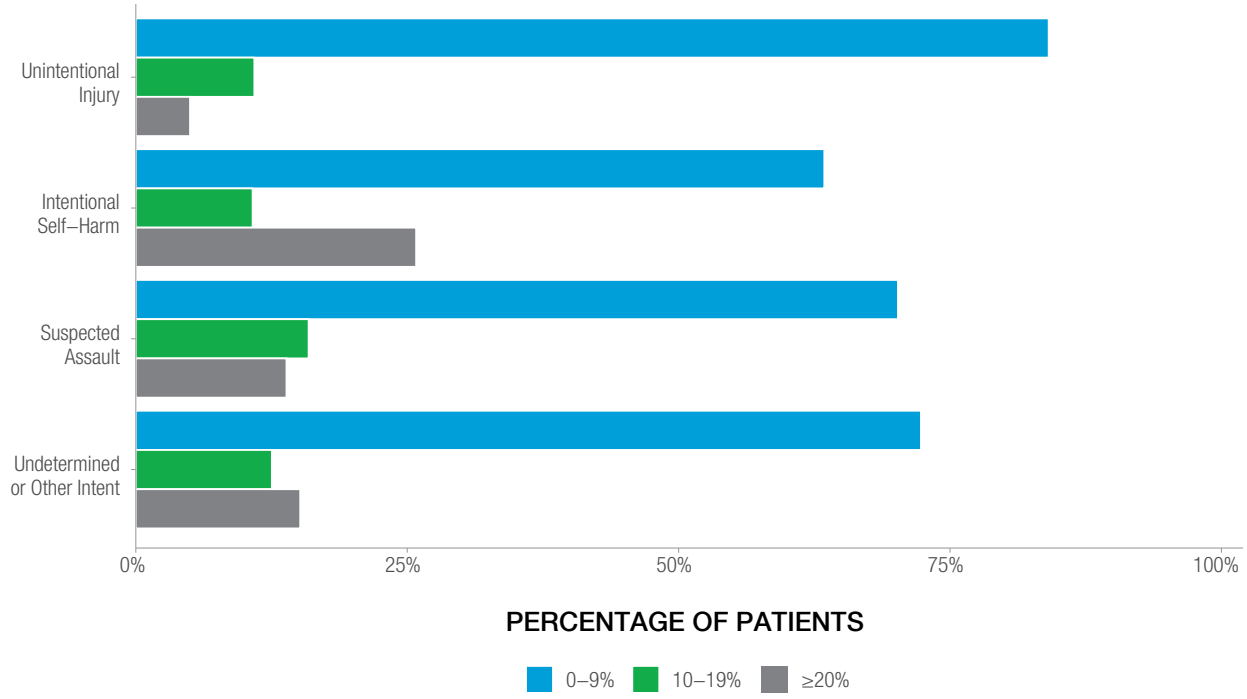
During the 2018/19 reporting period the majority of burns patients (94%) sustained their injury during unintentional events. Intentional self-harm accounted for three percent of all cases. The remaining cases included assaults, adverse effects or complications of medical treatment, or the intent was not known. This pattern of injury intent has remained consistent over the duration of the registry.

FIGURE 14 – Injury Intent for BRANZ Registered Patients by Reporting Period, 2009/10 to 2018/19



The proportion of unintentional burn injuries exceeded that of intentional injuries arising through self-harm for burns under 10% TBSA. However, for burns exceeding 10% TBSA, the proportion of intentional injuries from self-harming activities was greater than the proportion of unintentional injuries (Figure 15).

FIGURE 15 – Injury Intent by Burn Size for Registered BRANZ Patients, 2009/10 to 2018/19

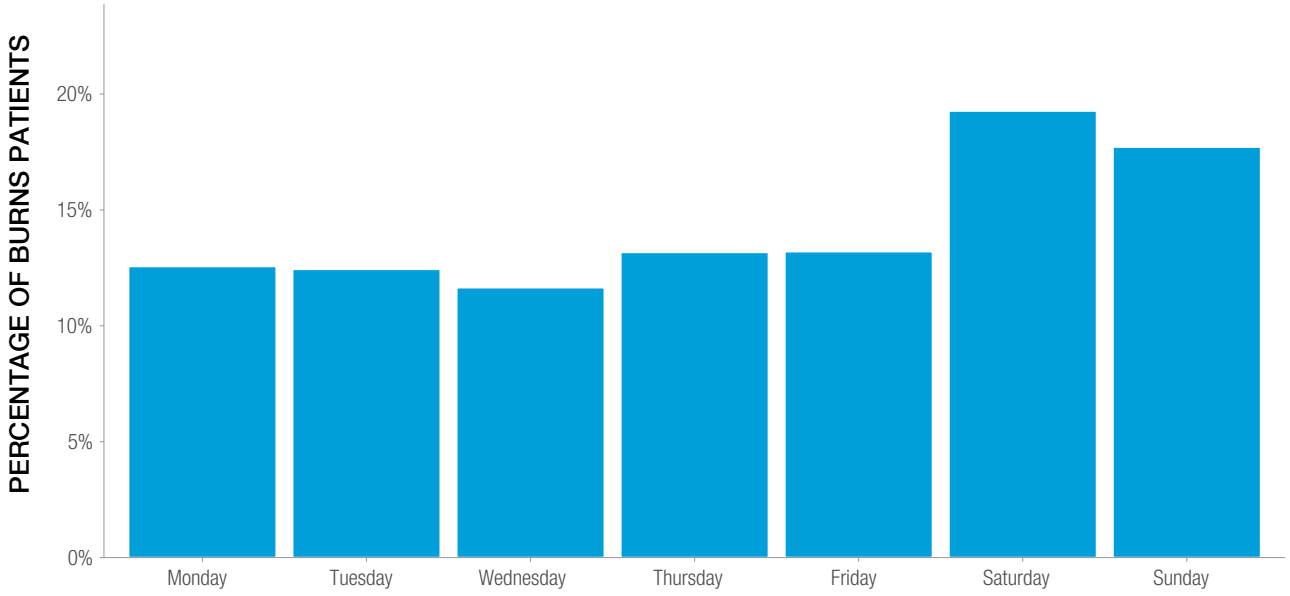


A smaller proportion of burn injuries in Australian Indigenous people were unintentional compared to non-Indigenous Australians. Instead, the injury intent was undetermined or unspecified for a larger proportion of Indigenous Australians.

DAY AND TIME OF INJURY

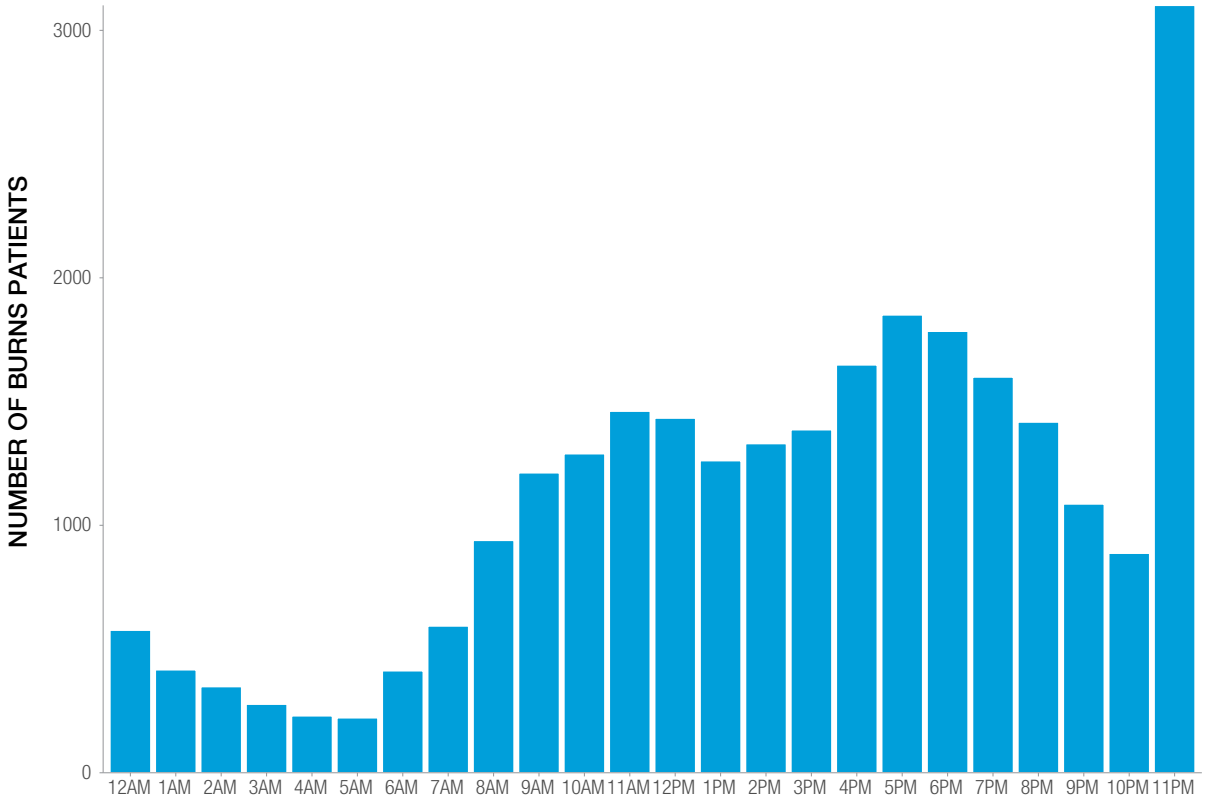
Consistent with other types of trauma, burn injuries occurred more frequently on weekends (37% of patients). The greatest proportion of injuries occurred on a Saturday (19%; Figure 16). This distribution has been consistent since the launch of the registry in July 2009.

FIGURE 16 – Proportion of Burn Injuries Occurring on Each Day of the Week, 2018/19



Of the cases with a known time of injury, nine percent occurred between the hours of 12AM and 6AM, 20% occurred between 4PM and 6PM, while 12% occurred between 11PM and 12AM. Further investigation of the distribution of the time of injury is required.

FIGURE 17 – Time of Admission For Registered BRANZ Patients, 2009/10 to 2018/19

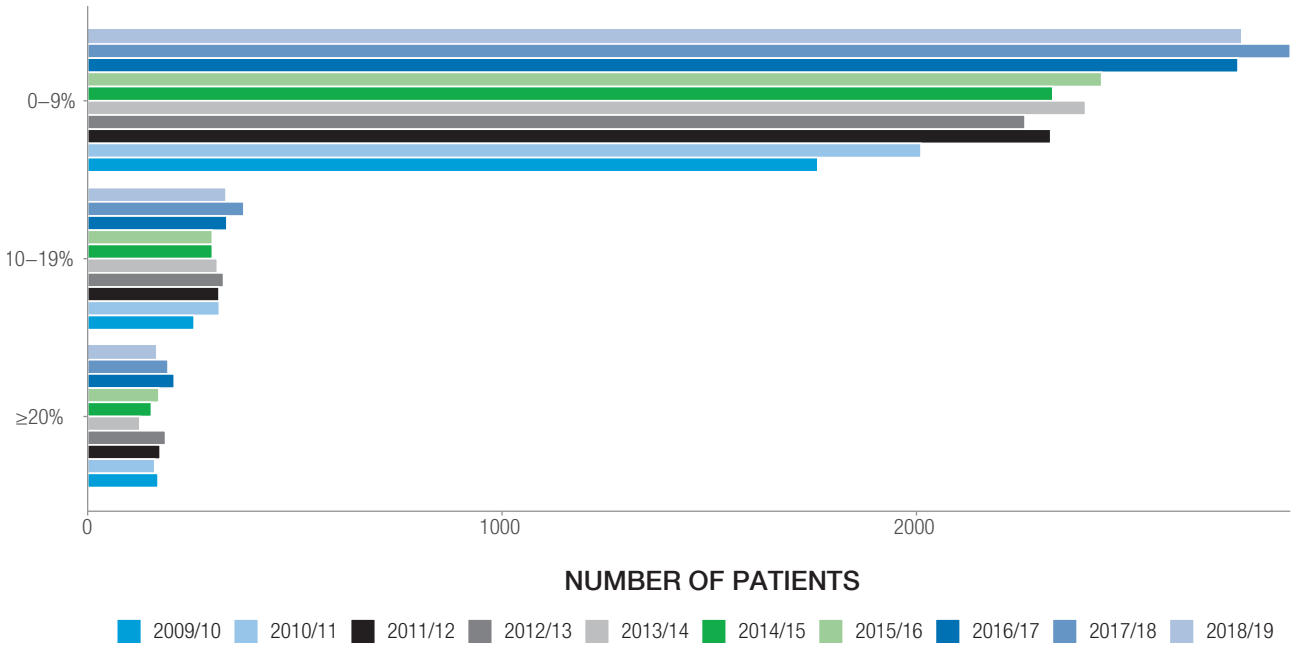


INJURY SEVERITY

Percentage Total Body Surface Area (%TBSA)

During the 2018/19 reporting period where the size of the burn was known, 85% cases had a burn less than 10% TBSA. Smaller burns have been much more common compared to larger burns throughout the previous reporting periods.

FIGURE 18 – Percentage Total Body Surface Area Burned by Reporting Period, 2009/10 to 2018/19



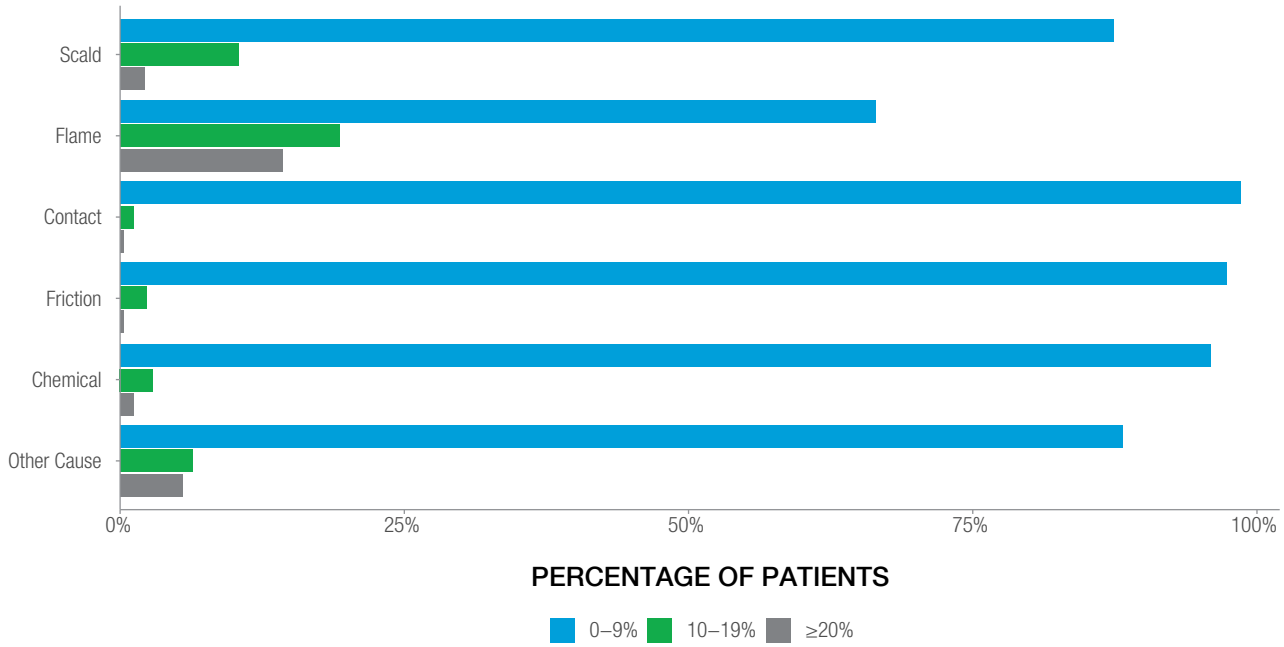
During the 2018/19 reporting period, 92% of paediatric patients sustained a burn less than 10% TBSA, and only one percent of patients sustained a burn greater than 20% TBSA. For adult patients, 82% of cases experienced a burn less than 10% TBSA, and seven percent experienced a burn greater than 20%. Older adults had a similar distribution of burn size compared to older adults.

TABLE 13 – Percentage Total Body Surface Area Burned by Age Group and Reporting Period, 2009/10 to 2018/19

	0-9% TBSA N (%)	10-19% TBSA N (%)	≥ 20% TBSA N (%)
Paediatric Patients (0-15 Years)			
2009/10	517 (87.6%)	57 (9.7%)	16 (2.7%)
2010/11	668 (87.3%)	75 (9.8%)	22 (2.9%)
2011/12	783 (87.6%)	82 (9.2%)	29 (3.2%)
2012/13	773 (88.3%)	76 (8.7%)	26 (3.0%)
2013/14	910 (88.9%)	97 (9.5%)	17 (1.7%)
2014/15	921 (89.8%)	85 (8.3%)	20 (1.9%)
2015/16	851 (88.1%)	84 (8.7%)	31 (3.2%)
2016/17	875 (88.1%)	80 (8.1%)	38 (3.8%)
2017/18	884 (88.6%)	94 (9.4%)	20 (2.0%)
2018/19	829 (91.5%)	64 (7.1%)	13 (1.4%)
TOTAL	**8,011 (88.6%)**	**794 (8.8%)**	**232 (2.6%)**
Adult Patients (16-64 Years)			
2009/10	1,108 (78.1%)	176 (12.4%)	135 (9.5%)
2010/11	1,199 (77.7%)	215 (13.9%)	129 (8.4%)
2011/12	1,340 (80.1%)	205 (12.3%)	128 (7.7%)
2012/13	1,303 (78.3%)	221 (13.3%)	140 (8.4%)
2013/14	1,302 (82.1%)	191 (12.0%)	93 (5.9%)
2014/15	1,226 (80.4%)	183 (12.0%)	115 (7.5%)
2015/16	1,386 (81.7%)	185 (10.9%)	126 (7.4%)
2016/17	1,630 (81.8%)	217 (10.9%)	145 (7.3%)
2017/18	1,726 (80.7%)	253 (11.8%)	161 (7.5%)
2018/19	1,674 (82.2%)	228 (11.2%)	135 (6.6%)
TOTAL	**13,894 (80.4%)**	**2,074 (12.0%)**	**1,307 (7.6%)**
Older Adult Patients (≥65 Years)			
2009/10	137 (76.1%)	24 (13.3%)	19 (10.6%)
2010/11	144 (78.7%)	28 (15.3%)	11 (6.0%)
2011/12	201 (80.7%)	30 (12.0%)	18 (7.2%)
2012/13	186 (77.8%)	31 (13.0%)	22 (9.2%)
2013/14	196 (82.7%)	25 (10.5%)	16 (6.8%)
2014/15	182 (77.8%)	33 (14.1%)	19 (8.1%)
2015/16	210 (82.4%)	32 (12.5%)	13 (5.1%)
2016/17	270 (80.6%)	39 (11.6%)	26 (7.8%)
2017/18	287 (87.0%)	30 (9.1%)	13 (3.9%)
2018/19	278 (82.5%)	42 (12.5%)	17 (5.0%)
TOTAL	**2,091 (81.1%)**	**314 (12.2%)**	**174 (6.8%)**

The distribution of burn injury cause varied according to the primary cause of the burn (Figure 19). For example, almost all contact burns were less than 10% TBSA. In contrast, a greater proportion of flame burns exceeded 20% TBSA.

FIGURE 19 – Percentage Total Body Surface Area Burnt by Injury Cause, 2009/10 to 2018/19



Larger burns were slightly more common in non-Indigenous Australian patients compared to Indigenous Australian patients.

TABLE 14 – Percentage Total Body Surface Area Burnt by Indigenous Status, 2009/10 to 2018/19

	Indigenous	Non-Indigenous
0-9%	1,401 (86.7%)	15,737 (83.6%)
10-19%	156 (9.7%)	2,072 (11.0%)
≥20%	55 (3.4%)	1,008 (5.4%)
Median (IQR) TBSA	2 (1-5)	3 (1-6.5)

IQR = interquartile range; TBSA = total body surface area.
Unless otherwise specified, data presented as frequency (percentage).

Burn Depth

As described in previous annual reports, improvements in the BRANZ database from July 2010 allowed for greater accuracy of reporting burn depth. The BRANZ reports on burn depth by documenting the presence of injuries involving superficial, mid-dermal, deep dermal, and full thickness burns. Burn injuries can include multiple areas of multiple depths. Burn depth was recorded for 94% of admissions during the 2018/19 reporting period. Of these, 40% had superficial burns, 49% had mid-dermal burns, and 41% had deep dermal burns. A full thickness burn was documented for 34% of cases, which is an increase on the previous reporting period. Note that it is possible for a patient to have burns of multiple depths.

TABLE 15 – Burn Depth Assessment and Groups by Reporting Period for Registered BRANZ Patients, 2009/10 to 2018/19

	Burn Depth Assessed N (%)	Superficial Dermal Burn N (%)	Mid-dermal Burn N (%)	Deep Dermal Burn N (%)	Full Thickness Burn N (%)
2009/10	1,664 (78.6%)	528 (32.2%)	926 (56.4%)	722 (43.9%)	90 (8.2%)
2010/11	2,163 (89.8%)	915 (42.6%)	1,072 (49.8%)	826 (38.4%)	445 (20.6%)
2011/12	2,352 (85.7%)	905 (38.7%)	1,208 (51.5%)	937 (39.9%)	484 (20.7%)
2012/13	2,325 (86.8%)	904 (39.2%)	1,183 (51.1%)	925 (40.8%)	457 (19.9%)
2013/14	2,501 (91.7%)	933 (37.6%)	1,313 (52.9%)	1,070 (43.1%)	442 (17.8%)
2014/15	2,499 (93.1%)	938 (38.1%)	1,308 (53.9%)	1,018 (41.0%)	551 (22.5%)
2015/16	2,625 (93.9%)	964 (37.6%)	1,361 (58.8%)	1,027 (39.8%)	551 (21.7%)
2016/17	3,078 (94.2%)	1,283 (44.7%)	1,366 (50.5%)	1,206 (44.9%)	861 (30.2%)
2017/18	3,273 (95.7%)	1,511 (48.9%)	1,415 (47.9%)	1,305 (44.5%)	920 (30.1%)
2018/19	3,010 (94.4%)	1,161 (40.2%)	1,412 (49.2%)	1,151 (40.7%)	983 (34.4%)
TOTAL	**25,940 (90.9%)**	**10,049 (40.5%)**	**12,571 (51.5%)**	**10,192 (41.7%)**	**5,786 (24.0%)**

Of the cases with a full thickness burn, the size of the full thickness burn area was known in 98% of cases. The proportion of patients with full thickness burn area of less than 10% TBSA has trended upwards since the 2015/16 reporting period.

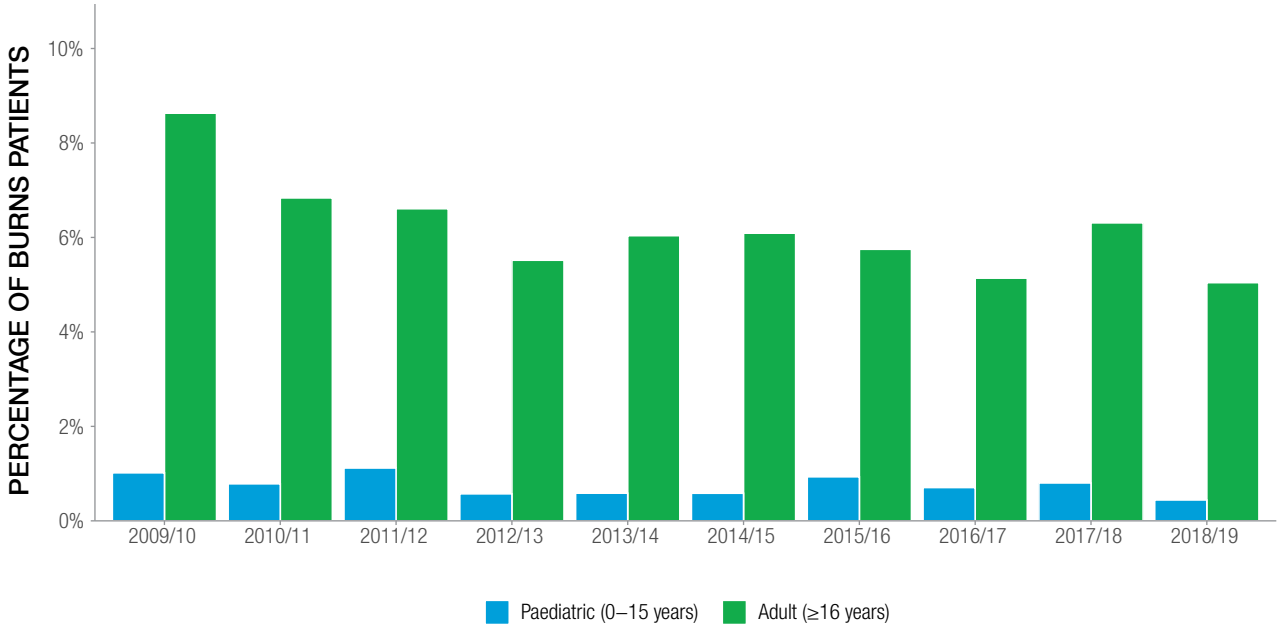
TABLE 16 – Distribution of Full Thickness Burn Size in Registered BRANZ Patients by Reporting Period, 2009/10 to 2018/19

	0-9% Full Thickness	10-19% Full Thickness	≥20% Full Thickness
2009/10	58 (80.6%)	9 (12.5%)	5 (6.9%)
2010/11	318 (88.8%)	15 (4.2%)	25 (7.0%)
2011/12	378 (89.2%)	15 (3.5%)	31 (7.3%)
2012/13	331 (86.2%)	20 (5.2%)	33 (8.6%)
2013/14	329 (87.7%)	23 (6.1%)	23 (6.1%)
2014/15	431 (89.6%)	25 (5.2%)	25 (5.2%)
2015/16	412 (86.2%)	20 (4.2%)	46 (9.6%)
2016/17	679 (86.8%)	38 (4.9%)	65 (8.3%)
2017/18	719 (88.2%)	45 (5.5%)	51 (6.3%)
2018/19	788 (89.7%)	51 (5.8%)	39 (4.4%)
TOTAL	**4,443 (88.0%)**	**261 (5.2%)**	**343 (6.8%)**

Inhalation Injury

Burns to the oropharynx and upper airway can result in swelling and possible airway obstruction within the first few hours after injury. Inhalation injury is suspected on the basis of a history of mechanism of injury, smoke exposure, clinical presentation, and diagnostic investigations. Inhalation injuries are associated with increased morbidity and mortality. An inhalation injury is recorded in the BRANZ if it is documented in the patient's medical record. There is currently no consensus globally or across BRANZ sites for diagnostic criteria and classification of severity of inhalation injuries[7]. Inhalation injuries are more common in adult patients compared to paediatrics; however, the rate of inhalation injury in paediatrics has remained consistent while the rate in adults has fluctuated more. A higher proportion of inhalation injuries in adults is consistent with flame being the most common cause of burn injury in adults. Eleven percent of patients who sustained an inhalation injury died.

FIGURE 20 – Patients with Inhalation Injury by Age Group and Reporting Period, 2009/10 to 2018/19



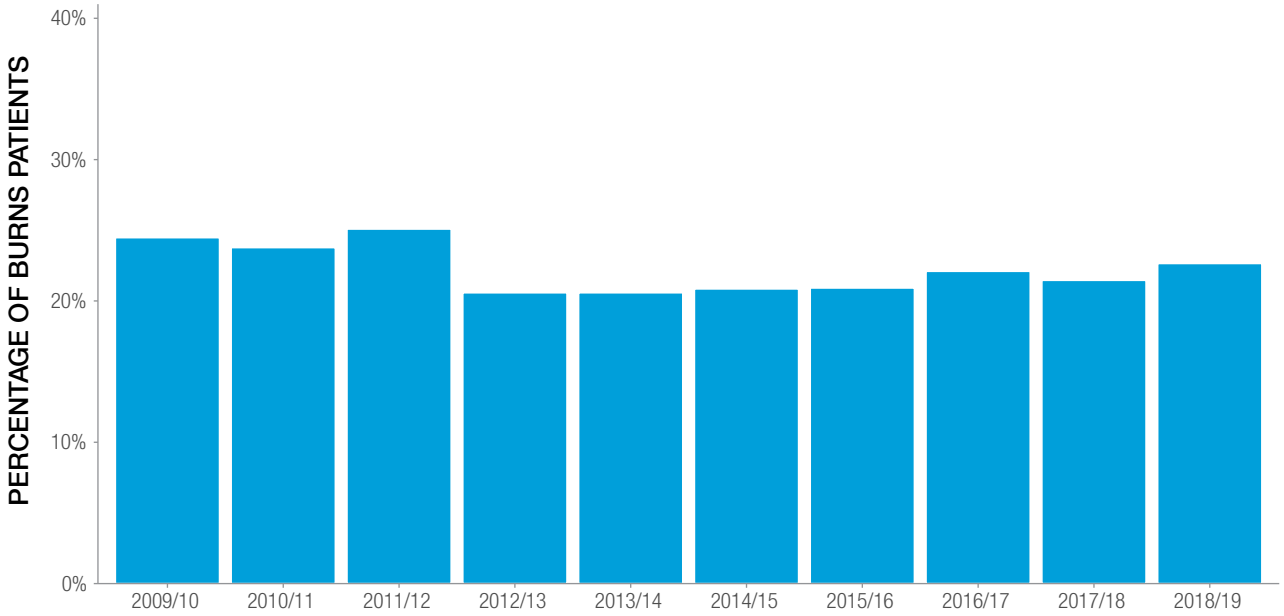
7 Tracy LM, Dyson K, Le Mercier L et al. (accepted 16/11/2019). Variation in documented inhalation injury rates following burn injury in Australia and New Zealand. Injury.

DRUG AND ALCOHOL INVOLVEMENT

Blood testing for alcohol or drug involvement is not routinely conducted for all burn patients and therefore the information captured is based on medical record documentation of suspicion of, or known, alcohol and/or drug involvement. This includes instances where there was confirmed or suspicion of alcohol and/or drugs contributing to the patient sustaining the burn injury; as well as children who were burnt as an indirect result of the parent or caregiver being under the influence of drugs and/or alcohol.

Nine percent of adult cases for the 2018/19 reporting period did not have a valid response to the documented suspicion of drug or alcohol involvement field. Where data were valid, 23% of cases had clinical documentation indicating there was confirmation or suspicion of alcohol or drugs contributing to the patient sustaining the burn injury. This figure has been consistent across the duration of the registry, varying from 20 to 25%.

FIGURE 21 – Documented Suspicion of Drug and Alcohol Involvement in Adult Burn Injuries by Reporting Period, 2009/10 to 2018/19



PRE-HOSPITAL MANAGEMENT OF BURN INJURIES

BURNS FIRST AID TREATMENT

Burn cooling is critical in the initial first aid response to a burn injury. Applying cool running water to the burn for 20 minutes within three hours of sustaining the injury reduces the area and depth of the burn[8].

There are three data fields relating to burns first aid treatment in the registry. The first question asks "Was any first aid applied to the burn wound?" with the possible responses being "yes", "no", and "not stated/ inadequately described". If patients received first aid, a follow-up question asks "Was the first aid applied 20 minutes of cool running water within three hours of injury?" with the same three responses. A free text field is also available to document any additional information regarding first aid. Based on the responses to these questions, patients were categorised into one of three comparator groups: (1) no first aid, (2) non-gold standard first aid – where first aid was applied but not 20 minutes of cool running water within three hours of injury, and (3) gold standard first aid – where cool running water was applied to the burn injury for at least 20 minutes within three hours of injury.

Eighty percent of all cases during the 2018/19 reporting period were reported to have received some kind of first aid following the burn injury. A higher proportion of paediatric patients received some form of first aid than adult and older adult patients, which is consistent with previous reporting periods. Gold standard first aid was applied in 71% of paediatric cases, 63% of adult cases, and only 50% of older adult cases.

TABLE 17 – Documented Standard of First Aid Following Burn Injury by Age Group, 2018/19

	Paediatric Patients (0-15 Years)	Adult Patients (16-64 Years)	Older Adult Patients (≥65 Years)
No First Aid	103 (12.1%)	388 (21.0%)	95 (33.0%)
Inadequate First Aid	142 (16.6%)	295 (16.0%)	50 (17.0%)
Gold Standard First Aid	609 (71.3%)	1,163 (63.0%)	145 (50.0%)

8 Bartlett N, Yuan J, Holland AJ et al. Optimum duration for cooling an acute scald contact burn injury in a porcine model. Journal of Burn Care & Research. 2008;29(5):828-834.

Cuttle L, Kempf M, Liu PY et al. The optimum duration and delay of first aid treatment for deep partial thickness burns. Burns. 2010;36(5):673-679.

Wood FM, Phillips M, Jovic T et al. Water first aid is beneficial in humans post-burn: Evidence from a bi-national cohort study. PLoS One. 2016;11(1):e0147259.

Yuan J, Wu C, Holland AJ et al. Assessment of cooling on an acute scald burn injury in a porcine model. Journal of Burn Care & Research. 2007;28(3):514-520.

The proportion of patients receiving gold standard first aid in major cities or inner regional areas was higher than that in remote areas of Australia. Identifying barriers to providing gold standard first aid in remote areas may be beneficial.

TABLE 18 – Documented Standard of First Aid Following Burn Injury by Geographic Remoteness, 2018/19

	Gold Standard First Aid	Inadequate First Aid	No First Aid
Major Cities of Australia	903 (65.8%)	209 (15.2%)	261 (19.0%)
Inner Regional Australia	330 (68.9%)	74 (15.5%)	75 (15.6%)
Outer Regional Australia	221 (62.3 %)	46 (13.0%)	88 (24.7%)
Remote Australia	44 (53.0%)	22 (26.5%)	17 (20.5%)
Very Remote Australia	18 (38.3%)	16 (34.0%)	13 (27.7%)

A smaller proportion of Indigenous Australian patients received gold standard first aid following burn injury compared to non-Indigenous Australians.

TABLE 19 – Documented Standard of First Aid Following Burn Injury by Indigenous Status, 2018/19

	Gold Standard First Aid	Inadequate First Aid	No First Aid
Indigenous Australians	87 (55.1%)	26 (16.5%)	45 (28.4%)
Non-Indigenous Australians	1,325 (64.3%)	317 (15.4%)	420 (20.4%)

REFERRAL SOURCE TO BURNS UNIT

The most common referral source across all age groups were other hospitals. A greater proportion of adult and older adult patients were referred via the emergency department compared to paediatric patients. Between 15% and 20% of patients arrived at the designated burns unit directly from the scene via an ambulance. Note that the outpatients referral source was not added to the registry until the beginning of the 2016/17 reporting period.

FIGURE 22 – Referral Source to Burns Unit for Registered BRANZ Patients by Reporting Period, 2009/10 to 2018/19

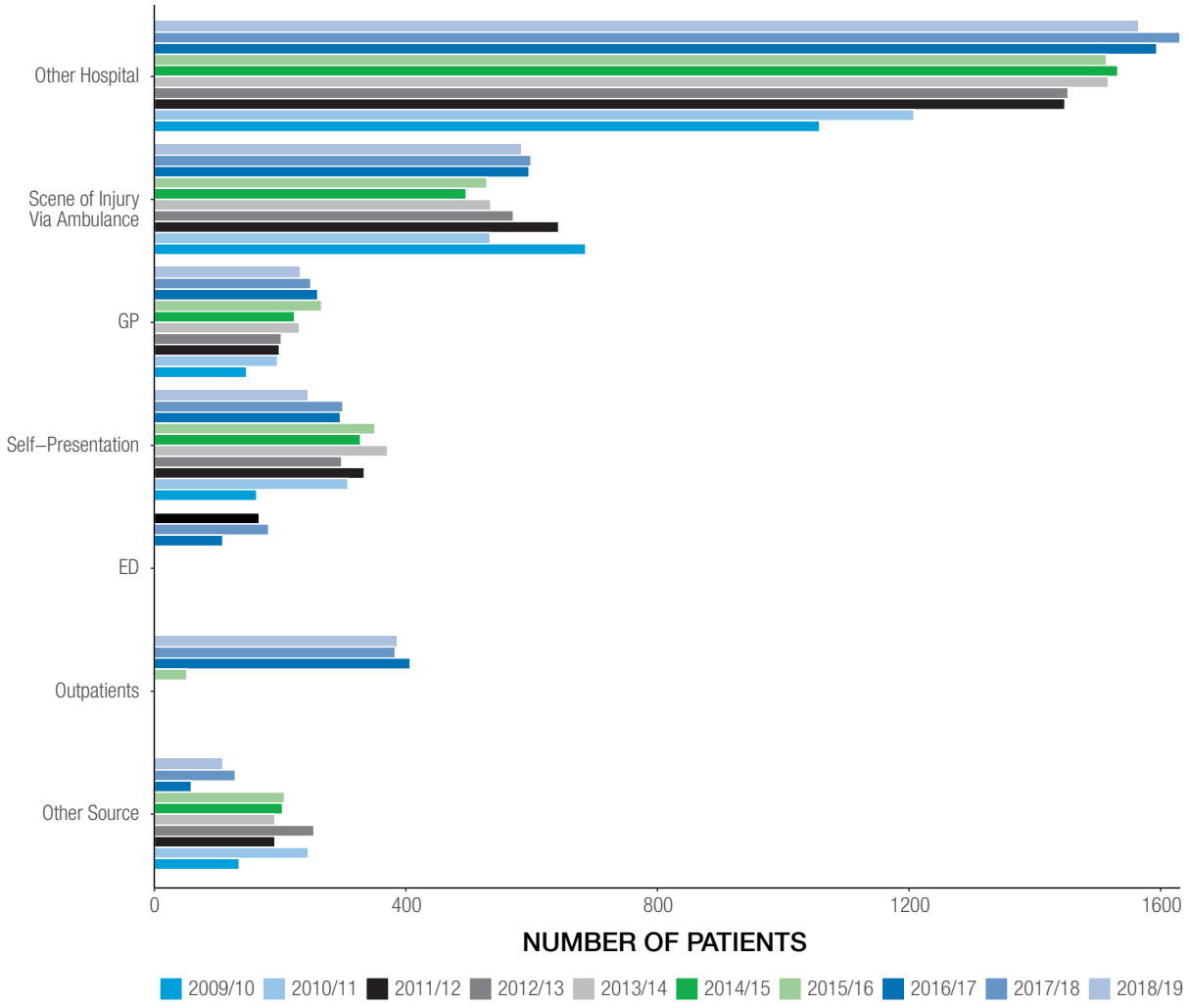


TABLE 20 – Referral Source to Burns Unit for Registered BRANZ Patients by Age Group, 2018/19

	Paediatric (0-15 Years)	Adult (16-64 Years)	Older adult (≥65 Years)
Scene of Injury Via Ambulance	134 (14.9%)	387 (19.0%)	61 (18.1%)
Other Hospital	478 (53.2%)	923 (45.3%)	160 (47.5%)
GP	77 (8.6%)	116 (5.7%)	38 (11.3%)
Self-Presentation	90 (10.0%)	137 (6.7%)	14 (4.2%)
ED	6 (0.7%)	146 (7.2%)	15 (4.5%)
Outpatients	84 (9.3%)	259 (12.7%)	39 (11.6%)
Other Source	30 (3.3%)	68 (3.3%)	10 (3.0%)

HOW LONG DID IT TAKE FOR THE BURN PATIENT TO BE ADMITTED TO A BURNS UNIT?

The time taken for a burn patient to be admitted from the scene of the burn injury to a BRANZ hospital significantly influences initial medical and surgical management of burn injuries. Given the centralised structure of burn care services across Australia and New Zealand, and the geographical size and distances required to travel to a burns unit and mode of transfer, identifying a standardised acceptable transfer time for benchmarking has been challenging in some states. The BRANZ therefore collects data on the length of time taken to admission from time of injury. This data will assist in developing acceptable timeframes for admission of patients to a BRANZ hospital, identify if pre-burns unit care was appropriate, and monitor outcomes of care where there have been delays. It is recognized that delayed admission may constitute appropriate care for specific injuries and in specific environments. The median (IQR) time from injury to admission to a BRANZ hospital for each reporting period are reported in Table 21. The median time to admission increases with age.

TABLE 21 – Time To Admission for Registered BRANZ Patients by Age Group and Reporting Period, 2009/10 to 2018/19

	Paediatric Patients (0-15 Years)	Adult Patients (16-64 Years)	Older Adult Patients (≥65 Years)	All Patients
2009/10	13.7 (2.6-167.0)	18.0 (4.0-86.9)	20.6 (5.5-90.3)	17.5 (3.8-95.3)
2010/11	9.2 (2.3-134.3)	12.0 (3.5-87.8)	29.0 (5.5-119.1)	12.2 (3.3-101.8)
2011/12	15.5 (3.3-138.2)	15.1 (3.5-103.1)	18.0 (5.1-128.8)	15.3 (3.5-112.4)
2012/13	18.7 (3.7-141.0)	14.4 (3.8-90.4)	16.8 (3.3-117.1)	16.0 (3.8-106.0)
2013/14	24.8 (4.1-190.2)	15.6 (3.9-91.0)	20.9 (4.9-111.7)	19.0 (4.1-115.4)
2014/15	22.0 (3.9-176.6)	15.7 (4.0-108.4)	26.7 (5.2-144.2)	18.3 (4-132.3)
2015/16	19.3 (3.7-189.5)	21 (4.4-117.9)	35.8 (5.1-151.8)	21.1 (4.2-133.8)
2016/17	25.7 (3.5-207.0)	31.7 (5.1-134.8)	42.2 (6.4-137.1)	31.4 (4.7-142.3)
2017/18	26.6 (3.8-189.6)	30.9 (5.4-138.1)	48.4 (8.3-163.0)	31.8 (4.9-149.8)
2018/19	23.9 (4.1-182.5)	33.8 (5.4-136.6)	51.8 (7.9-178.0)	31.1 (5.2-148.2)
TOTAL	**20.4 (3.5-173.7)**	**19.9 (4.3-112.0)**	**28.0 (5.8-137.4)**	**20.9 (4.1-126.8)**

The initial treatment of a burn patient is critical for reducing the risk of complications, poor long-term outcomes and mortality. The ANZBA advocate that referring hospitals consult with the burn unit as soon as possible to assist with the initial treatment plan and in triaging the patients requiring transfer. A burn size greater than 20% TBSA in adult cases and greater than 15% TBSA in paediatric cases can be considered as a major burn.

Figures 23 and 24 show the median time from injury to admission for major paediatric and adult cases for each reporting period. The median values for time to admission for both paediatric and adult cases have remained consistent over the life of the registry.

FIGURE 23 – Time to Admission for Major Paediatric Burns by Reporting Period, 2009/10 to 2018/19

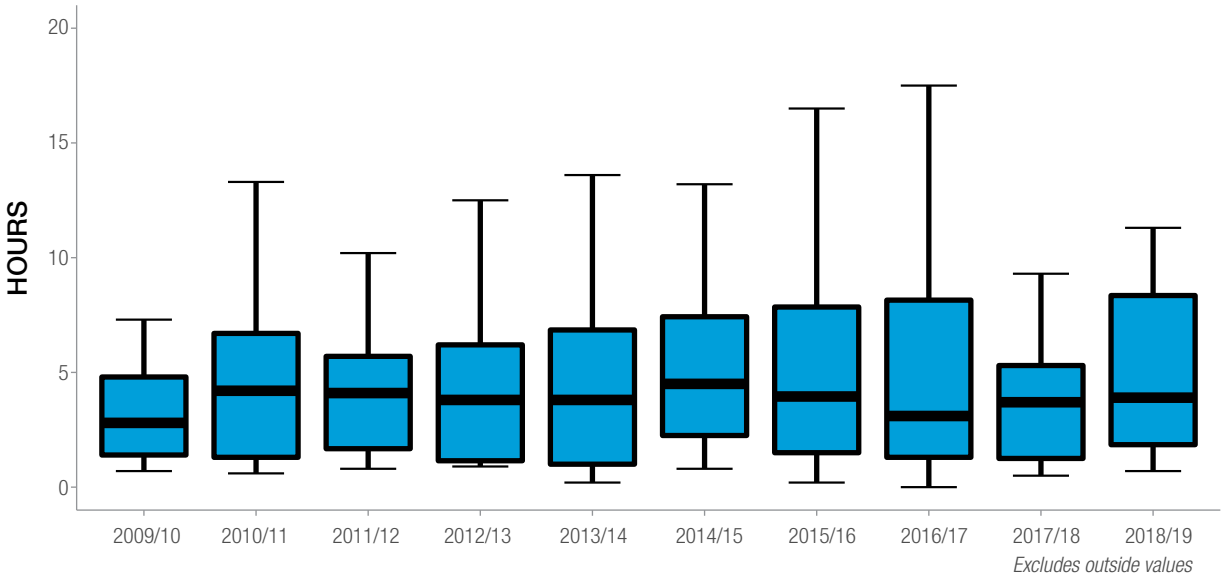
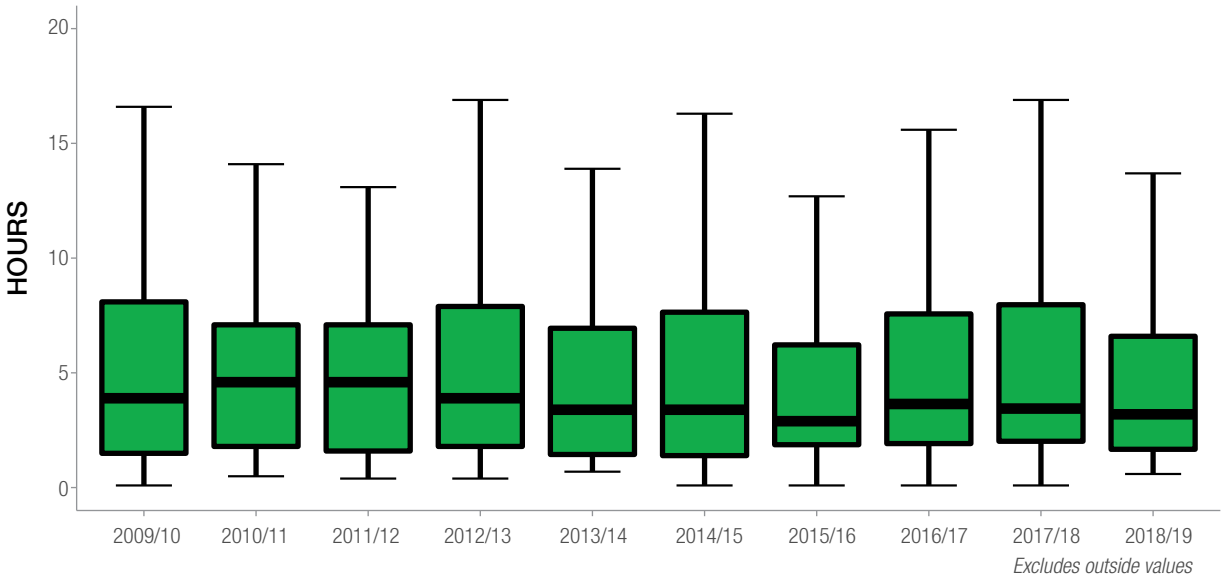


FIGURE 24 – Time to Admission for Major Adult Burns by Reporting Period, 2009/10 to 2018/19



BURN UNIT PERFORMANCE

The following pages provide information on the various process and outcome indicators collected by the registry. The first process and outcome indicators were implemented in 2009. A major review and revision of quality indicators in 2016 resulted in a revised and extended quality indicator dataset[9].

WOUND ASSESSMENT

The definitive burn wound assessment is defined as the burn assessment documented by a senior burns clinician within 72 hours of admission. A definitive wound assessment was documented within 72 hours of admission in 98% of paediatric cases, in 98% of adult cases, and 96% of older adult cases. These figures have remained reasonably consistent since the 2012/13 reporting period.

TABLE 22 – Proportion of Patients Receiving a Burn Assessment by a Senior Burn Clinician Within 72 Hours of Admission by Age Group and Reporting Period, 2009/10 to 2018/19

	Paediatrics (0-15 Years)	Adults (16-64 Years)	Older Adults (≥65 Years)
2009/10	422 (87.0%)	961 (91.7%)	120 (89.6%)
2010/11	557 (98.6%)	1,166 (97.7%)	137 (97.2%)
2011/12	591 (94.3%)	1,290 (98.6%)	199 (98.5%)
2012/13	596 (98.0%)	1,294 (99.1%)	189 (98.4%)
2013/14	649 (98.6%)	1,146 (96.1%)	178 (93.7%)
2014/15	683 (98.4%)	1,068 (96.3%)	173 (93.5%)
2015/16	656 (99.1%)	1,082 (96.4%)	174 (94.1%)
2016/17	657 (99.4%)	1,287 (97.0%)	229 (92.3%)
2017/18	788 (99.6%)	1,405 (97.0%)	217 (93.9%)
2018/19	692 (98.3%)	1,300 (97.6%)	240 (96.0%)
TOTAL	**6,291 (97.5%)**	**11,999 (96.9%)**	**1,856 (94.8%)**

9 Gong J, Singer Y, Cleland H et al. (accepted 16/01/2020). Driving improved burns care and patient outcomes through clinical registry data: A review of quality indicators in the Burns Registry of Australia and New Zealand. Burns.

THEATRE ADMISSIONS

The BRANZ collects data on whether patients underwent a burn management procedure to better understand wound management practices within Australia and New Zealand. This understanding will serve as a foundation to identify best practices in the surgical management of burn injuries. Note that each patient may have multiple burn wound management procedures, but data is only collected for the first surgical episode of a particular wound closure procedure (e.g., use of dermal reconstructive product, use of skin cell product, etc.). It is possible that multiple procedures are performed in the same theatre episode.

Seventy-six percent of all cases underwent at least one burn wound management procedure in an operating theatre during the 2018/19 reporting period, and this is consistent with previous reporting periods. The proportion of adult patients being admitted to theatre (79%) is higher than that of paediatric patients (72%) and older adult patients (72%). These figures have remained reasonably consistent over the life of the registry.

FIGURE 25 – Burn Wound Management Procedures in Theatre by Age Group and Reporting Period, 2009/10 to 2018/19

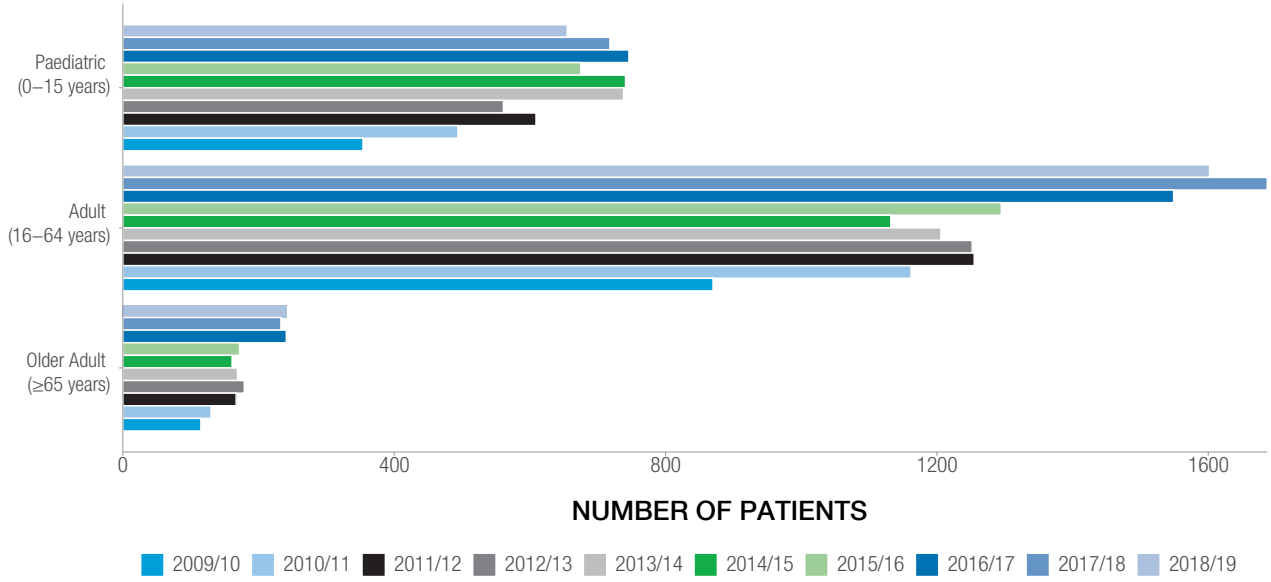


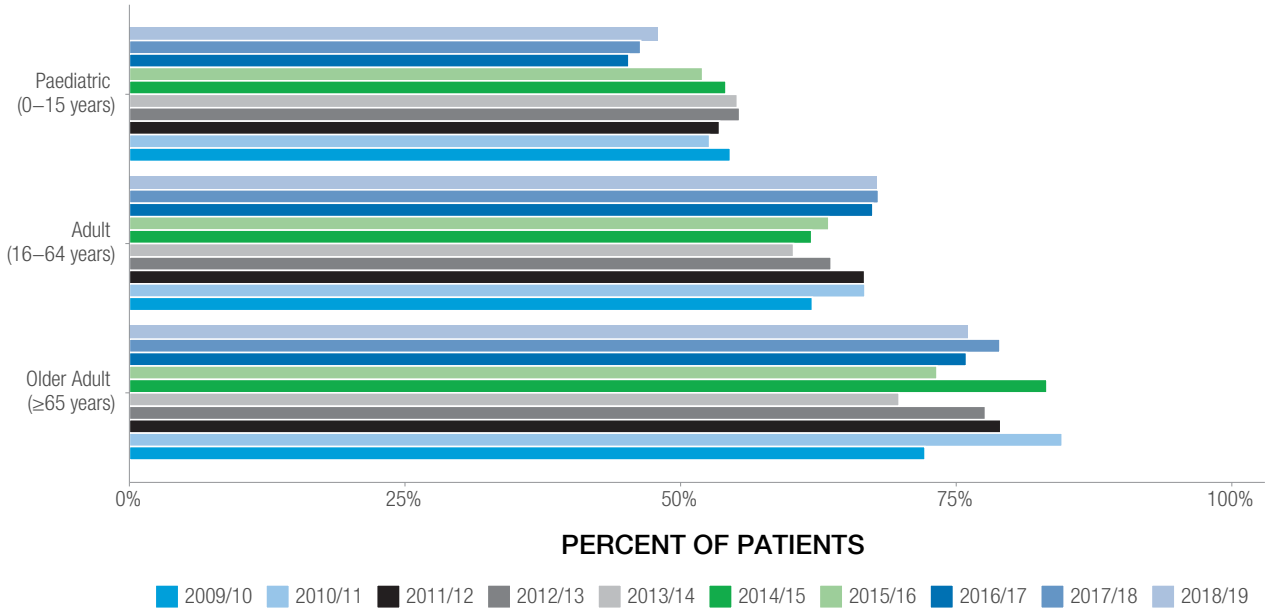
Table 23 outlines the percentages of paediatric, adult, and older adult patients that underwent particular burn wound management procedures in theatre. There are age-related differences in the proportion of patients undergoing different procedures. For example, debridement and skin grafting is more common in adult and older adult patients compared to paediatric patients, while undergoing a dressing change in theatre is more common in paediatric patients compared to their older counterparts.

TABLE 23 – Burn Wound Management Procedures by Age Group, 2018/19

	Paediatric Patients (0-15 Years)	Adult Patients (16-64 Years)	Older Adult Patients (≥65 Years)
Procedures Relating to Debridement			
Debridement Only	136 (20.8%)	344 (21.5%)	46 (19.0%)
Debridement and Temporary Skin Closure Product e.g. Biobrane ™	84 (12.8%)	351 (21.9%)	32 (13.2%)
Debridement and Dermal Reconstructive Product e.g. Integra ™ or Other Biodegradable Temporising Matrix	* (< 1%)	13 (< 1%)	* (< 1%)
Debridement and Skin Cell Product	110 (16.9%)	185 (11.6%)	14 (5.8%)
Debridement and Skin Grafting	314 (48.0%)	1,086 (67.8%)	184 (76.0%)
Debridement and Temporary Skin Closure With Cadaver Skin	5 (< 1%)	38 (2.4%)	10 (4.1%)
Other Procedures			
Dressing Change in Theatre Only	109 (16.6%)	29 (1.8%)	* (< 1%)
Escharotomy, Fasciotomy, Amputation	0 (0%)	20 (1.3%)	11 (4.5%)
Other Procedure	10 (1.5%)	38 (2.4%)	5 (2.1%)

The proportion of paediatric patients receiving a skin graft during their acute admission has decreased from 54.5% during the 2009/10 reporting period to 47.9% in the 2018/19 reporting period. In contrast, the proportion of adult and older adult patients receiving a skin graft during their acute admission increased from 62% and 72% to 67% and 76%, respectively.

FIGURE 26 – Skin Grafting by Age Group and Reporting Period, 2009/10 to 2018/19



The median time to first theatre from admission during the 2018/19 reporting period was 0.6 days. This figure has remained reasonably constant over the lifespan of the registry. The median time from admission to first theatre increases with patient age.

TABLE 24 – Median Days to First Theatre from Admission by Reporting Period and Age Group, 2009/10 to 2018/19

	Overall	Paediatrics (0-15 Years)	Adults (16-64 Years)	Older Adults (≥65 Years)
2009/10	0.8 (0.1-3.6)	0.2 (0.1-0.6)	1.1 (0.3-3.8)	3.6 (0.3-8)
2010/11	0.8 (0.2-2.8)	0.3 (0.1-0.8)	0.9 (0.3-3)	1.6 (0.7-4.4)
2011/12	0.7 (0.2-2.2)	0.5 (0.1-1.6)	0.8 (0.2-2.3)	1.2 (0.5-3.4)
2012/13	0.7 (0.2-1.9)	0.4 (0.1-1.5)	0.8 (0.2-1.8)	1.3 (0.4-3.7)
2013/14	0.6 (0.1-1.8)	0.3 (0.1-1.0)	0.8 (0.2-1.9)	1.4 (0.5-3.8)
2014/15	0.6 (0.1-1.5)	0.3 (0.1-0.8)	0.7 (0.2-1.6)	1.6 (0.6-3.7)
2015/16	0.5 (0.1-1.3)	0.3 (0.1-0.8)	0.6 (0.1-1.4)	1.1 (0.3-2.7)
2016/17	0.6 (0.1-1.5)	0.2 (0.1-0.8)	0.7 (0.1-1.6)	1.1 (0.5-3.0)
2017/18	0.6 (0.1-1.6)	0.2 (0.1-0.9)	0.7 (0.2-1.6)	1.0 (0.3-2.9)
2018/19	0.6 (0.1-1.7)	0.3 (0.1-0.9)	0.6 (0.2-1.7)	1.0 (0.2-2.8)
TOTAL	**0.6 (0.1-1.7)**	**0.3 (0.1-0.9)**	**0.7 (0.2-1.8)**	**1.2 (0.4-3.4)**

The median time to skin grafting from injury during the 2018/19 reporting period was 7.4 days. This figure has fluctuated over the lifespan of the registry. There is much debate amongst the burns community as to if early excision and grafting is beneficial and associated with better outcomes.

TABLE 25 – Median Days to Grafting from Injury by Reporting Period and Age Group, 2009/10 to 2018/19

	Overall	Paediatrics (0-15 Years)	Adults (16-64 Years)	Older Adults (≥65 Years)
2009/10	8.5 (4.7-12.0)	11.3 (7.5-14.8)	6.9 (4.2-10.3)	8.6 (5.1-11.6)
2010/11	7.0 (4.2-11.6)	11.1 (5.85-14.3)	6.2 (3.6-9.8)	7.8 (4.6-12.6)
2011/12	7.0 (3.8-11.1)	10.1 (5.9-14.8)	6.0 (3.5-9.6)	6.9 (3.7-10.5)
2012/13	6.7 (3.5-11.6)	10.7 (6.6-14.8)	5.5 (2.8-9.9)	6.7 (3.7-11.0)
2013/14	7.7 (3.9-12.1)	10.9 (7.3-14.1)	5.6 (3.4-10.6)	7.8 (4.5-11.0)
2014/15	7.8 (4.3-12.8)	10.8 (6.4-14.2)	6.5 (3.7-11.4)	8.0 (4.8-13.3)
2015/16	7.4 (4.1-12.0)	11.0 (6.7-14.9)	6.0 (3.5-10.4)	7.7 (4.0-11.6)
2016/17	7.5 (3.9-12.8)	12.6 (8.5-16.2)	6.0 (3.5-10.9)	6.8 (3.8-12.5)
2017/18	7.7 (3.9-12.6)	12.3 (8.5-15.6)	6.1 (3.4-10.6)	8.5 (5.1-13.6)
2018/19	7.4 (3.8-12.6)	11.2 (6.9-14.4)	6.0 (3.5-11.4)	7.8 (4.4-12.7)
TOTAL	**7.4 (3.9-12.1)**	**11.2 (6.8-14.8)**	**6.0 (3.5-10.5)**	**7.6 (4.4-11.9)**

PHYSICAL FUNCTIONING ASSESSMENT

Rehabilitation following burn injury requires a coordinated approach from a specialised multi-disciplinary team to minimise the consequences of burns, such as scarring, contractures and loss of function[10]. Allied health burn clinicians are responsible for assessing burns patients and commencing rehabilitation as early as possible, ideally in the acute treatment phase. The registry collects data on whether patients with a length of stay greater than 48 hours have a physical functioning assessment by a physiotherapist within 48 hours of admission. A greater proportion of paediatric and older adult patients received an assessment during the 2018/19 reporting period compared to the previous one, while a smaller proportion of adult patients received an assessment during this reporting period compared to the 2017/18 period.

TABLE 26 – Physical Functioning Assessment Rates Within 48 Hours of Burn Injury by Age Group, 2018/19

	Overall	Paediatrics (0-15 Years)	Adults (16-64 Years)	Older Adults (≥65 Years)
2017/18	1,883 (84.4%)	275 (55.4%)	1,367 (93.0%)	240 (90.9%)
2018/19	1,809 (84.7%)	287 (62.5%)	1,268 (90.6%)	254 (91.7%)

ENTERAL AND PARENTERAL FEEDING

Burn injury increases the body's metabolic requirements. The early provision of an adequate supply of nutrients is considered crucial in reducing the effects of metabolic abnormalities[11], and in reducing the risk of gastrointestinal dysfunction. The registry collects data on whether patients with major burns receive supplemental nutrition within 24 hours of arrival at the burn unit. A smaller proportion of patients with major burns commenced enteral or parenteral nutrition within 24 hours of admission during the 2018/19 reporting period compared to the 2017/18 period. This decline may be explained by not all sites contributing data by the data entry deadline.

TABLE 27 – Enteral or Parenteral Feeding Within 24 Hours of Admission in Major Burns Patients by Adult Status and Reporting Period, 2018/19

	All Patients	Paediatric Patients (0-15 Years)	Adult Patients (≥16 Years)
2017/18	128 (75.3%)	24 (82.8%)	104 (73.8%)
2018/19	90 (69.2%)	10 (62.5%)	80 (70.2%)

10 Australian and New Zealand Burns Association & Joanna Briggs Institute. Burn Trauma Rehabilitation: Allied Health Professional Allied Health Practice Guidelines. Philadelphia, PA; 2014.

11 Wasiak J, Cleland H, Jeffery R. Early versus delayed enteral nutrition support for burn injuries. Cochrane Database Syst Rev. 2006;(3):CD005489.

RENAL IMPAIRMENT

Acute renal failure can develop during the early resuscitation stage in treating a burn injury and is associated with complications and poor outcomes in severe burn injury[12]. Calculating RIFLE criteria[13] from serum creatinine and estimated glomerular filtration rate (eGFR) is a quantifiable and valid measure of renal function, and an indication of prognosis. A negative change in excess of 25% of eGFR relative to a baseline measurement is considered indicative of a risk of kidney injury as per the RIFLE criteria. The registry collects data on baseline (within 24 hours of admission) and lowest (within 72 hours of admission) values eGFR and can subsequently identify the risk of kidney injury as per the RIFLE criteria. While acute renal impairment may be an indicator of suboptimal resuscitation, there are significant difficulties with establishing baseline renal function in burns patients. Of the patients with at least two valid data points for eGFR, four percent of paediatric cases and three percent of adult cases were deemed to be at risk of kidney injury and failure during the 2018/19 reporting period. There was no change relative to the 2017/18 reporting period.

POSITIVE BLOOD CULTURES

Bloodstream infection is associated with increased risk of mortality in burn injured patients[14]. Blood cultures are used to detect infections that may spread through the bloodstream of patients such as bacteraemia and septicaemia. The registry collects data on if blood cultures were collected for patients during their admission and whether these cultures were positive or negative. A blood culture was collected during nine percent of paediatric admissions and 20% of adult admissions during the 2018/19 reporting period; both decreases on the 2017/18 reporting period. Where blood cultures were collected, positive cultures were identified for seven percent of paediatric cases (an increase from four percent in 2017/18) and eight percent of adult cases (consistent with the 2017/18 data).

MULTI-DRUG RESISTANT ORGANISMS

The presence of multi-drug resistant organisms (MROs) can be an indicator of hand hygiene practices and the overuse of antibiotics. The registry collects data on four MROs: Methicillin-resistant Staphylococcus Aureus (MRSA), Vancomycin-resistant Enterococcus (VRE), Carbapenem-resistant Pseudomonas (CRP), and Carbapenem-resistant Enterobacter (CRE). During the 2018/19 reporting period two percent of paediatric patients had a positive swab for MRSA, while less than one percent of cases had a positive swab for the other three MROs. The 2018/19 reporting period had fewer positive MRSA swabs in paediatric patients compared to the previous reporting period; results for the remaining MROs were consistent. For adult patients, nine percent of cases had a positive swab for MRSA, while less than one percent of cases had a positive swab for the other three MROs. Although the VRE, CRP, and CRE data for the 2018/19 reporting period is consistent with the 2017/18 period, there was an increase in the percentage of cases who were positive for MRSA from two percent in the 2017/18 period.

12 Mosier MJ, Pham TN, Klein MB, Gibran NS, Arnoldo BD, Gamelli RL, et al. Early acute kidney injury predicts progressive renal dysfunction and higher mortality in severely burned adults. Journal of burn care & research. 2010;31(1):83-92.

13 Kidney Health Australia. The eGFR Calculator 2019 [Available from: https://kidney.org.au/health-professionals/detect/calculator-and-tools].

14 Patel BM, Paratz JD, Mallet A et al. Characteristics of bloodstream infections in burn patients: An 11-year retrospective study. Burns. 2012;38(5):685-690.

PAIN ASSESSMENT

Pain is often the most frequent complaint following burn injury. The assessment of pain is vital in determining the most effective management. Early intervention minimises the risk of long-term sequelae such as chronic pain. As a sign of good quality care, it is reasonable to expect that a patient who has been admitted for a burn injury should have an assessment of their pain within 24 hours of admission. The pain assessment should be completed using one of the following validated tools: the short-form McGill questionnaire[15], the short- or long-form of the Brief Pain Inventory[16], the Pain Disability Index[17], a numeric rating scale, a verbal descriptor scale, a pain thermometer, a visual analogue scale, or a pictorial pain scale such as the FACES pain scale. A greater proportion of paediatric patients received a pain assessment compared to adult patients. The proportion of patients receiving a pain assessment during 2018/19 was slightly lower than the proportion in 2017/18.

TABLE 28 – Validated Pain Assessment Within 24 Hours of Admission by Age Group, 2018/19

	All Patients	Paediatrics (0-15 Years)	Adults (16-64 Years)	Older Adults (≥65 Years)
2017/18	3,193 (93.0%)	938 (94.8%)	1,953 (92.3%)	302 (91.8%)
2018/19	2,995 (92.0%)	847 (94.7%)	1,842 (91.0%)	306 (91.1%)

15 Melzack R. The short-form McGill Pain Questionnaire. Pain. 1987;30(2):191-7.

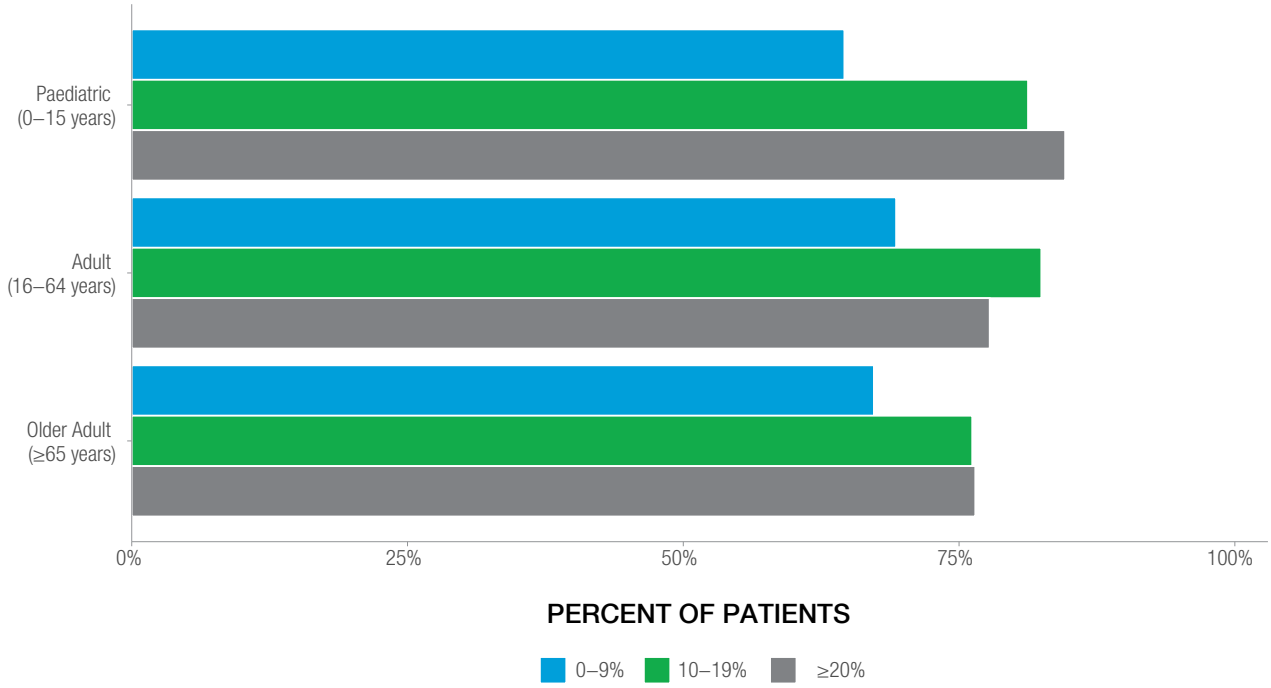
16 Cleeland CS, Ryan KM. Pain assessment: Global use of the Brief Pain Inventory. Annals of the Academy of Medicine, Singapore. 1994;23(2):129-38.

17 Tait RC, Chibnall JT, Krause S. The Pain Disability Index: psychometric properties. Pain. 1990;40(2):171-82.

DIAGRAM USE IN BURN SIZE ASSESSMENT

Specialised burn care includes an accurate estimation of the percentage TBSA of the burn. The percentage TBSA of the burn is used to determine the severity of the burn and accurately calculate the fluid resuscitation requirements. The Lund Browder chart[18] and the Wallace rule of nines diagram[19] are accepted tools used in the estimation of TBSA percentage. The registry collects data on whether an accepted tool was accurately used to calculate the size of the burn without restriction; that is, all patients should have a response to this data field. Seventy-three percent of patients in the 2018/19 reporting period had their burn size assessed using an accepted tool, and increase on the 70% of patients in the previous reporting period. The use of a Lund Browder chart or Wallace rule of nines diagram was more common in adult (76%) and older adult (75%) patients compared to paediatric patients (66%) during the 2018/19 reporting period. The use of an accepted tool to estimate burn size was more common in patients with larger burns, particularly for paediatric patients, during the 2018/19 reporting period.

FIGURE 27 – Accepted Diagram Use to Estimate Burn Size by Age Group and Burn Size, 2018/19



18 Lund CC, Browder NC. The estimation of areas of burns. Surgery Gynecology and Obstetrics. 1944;79:352.

19 Victorian Adult Burns Service. Wallace Rule of Nine – Adults 2019 [Available from: https://www.vicburns.org.au/burn-assessment-overview/burn-tbsa/rule-of-nine/].

MALNUTRITION RISK SCREENING

A significant proportion of patients admitted to hospital are at risk of malnutrition. Each year, patients in Australian hospitals experience more than 5,400 episodes of hospital-acquired malnutrition, which have been associated with increased hospital length of stay and associated healthcare costs[20]. For patients with burn injuries, malnutrition is associated with a range of complications and can delay wound healing and closure.

Malnutrition screening of all patients is recognised best practice. It identifies vulnerable patients who are, or may be, at risk of malnutrition to enable the commencement of a preventive management plan. In Australia, malnutrition risk screening of all patients on admission is a key performance measure for all healthcare organisations, including those housing burns units[21]. This information aligns with the Australian Commission on Safety and Quality in Health Care's (ACSQHC) National Safety and Quality Health Service (NSQHS) Standards (second edition), in particular the Comprehensive Care Standard 7, to support the delivery of safe patient care[22].

Where patients have a length of stay exceeding 24 hours, the registry collects data on whether the patient was screened for the risk of malnutrition within 24 hours of admission. The proportion of paediatric patients receiving a malnutrition risk screening increased from 37% in 2017/18 to 57% in 2018/19, as did the proportion of adult (79% to 80%) and older adult (77% to 79%) patients.

FORMULA USE IN FLUID REQUIREMENT ESTIMATION

Specialised burn care includes an accurate estimation of fluid resuscitation requirements in severe burns. Adequate fluid resuscitation remains a cornerstone of quality early burn care, as it restores circulating blood volume, preserves vital organs, and maintains tissue perfusion. The registry collects data on whether there was evidence or documentation that an accepted formula (either the modified Parkland formula[23] or the modified Brooke formula[24]) were used to estimate the fluid resuscitation requirements of patients with major burns within 24 hours of admission to the burns unit. During the 2018/19 reporting period there was evidence that an accepted formula was used in 90.5% of paediatric cases with major burns, an increase from the 84.2% in 2017/18. However, there was a decrease in adult cases with major burns, falling from 89.6% in 2017/18 to 86.0% in 2018/19.

20 Independent Hospital Pricing Authority. Activity Based Funding Admitted Patient Care 2015-16, acute admitted episodes, excluding same day

21 Australian Commission on Safety and Quality in Health Care. Selected best practices and suggestions for improvement for clinicians and health system managers: Hospital-acquired complication 13 – Malnutrition. Available from https://www.safetyandquality.gov.au/sites/default/files/migrated/Malnutrition-detailed-fact-sheet.pdf.

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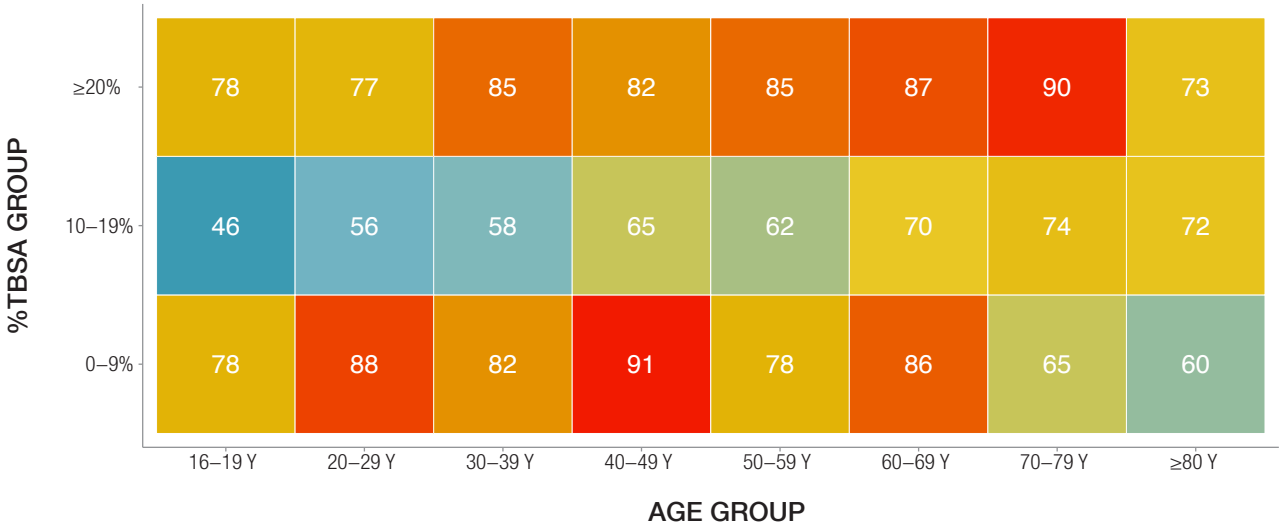
23 Haberal M, SAbali AES, Karakayali H. Fluid management in major burn injuries. Indian J Plast Surg. 2010;43:S29-36.

24 Zodda D. Calculated decisions: Parkland formula for burns. Emerg Med Pract. 2018;20:S1-2.

VENOUS THROMBOEMBOLISM PROPHYLAXIS

Venous thromboembolic events (e.g., deep venous thrombosis, pulmonary emboli) are a significant risk for all hospitalised patients, but patients with burn injuries are at a theoretically higher risk of having such an event[25]. Venous thromboembolic prophylaxis is used in adult burn patients to prevent venous thrombosis and pulmonary embolism. Commonly prescribed medications for venous thromboembolism prophylaxis include enoxaparin, heparin, and warfarin. The registry collects data on whether prophylaxis was prescribed for patients over the age of 16. There was a slight increase in the use of venous thromboembolism prophylaxis during the 2018/19 reporting period compared to the previous year; rising from 64.3% to 67.2%. A similar trend was seen in adult patients with major burns, increasing from 82.7% in 2017/18 to 85.5% in 2018/19. Figure 28 displays the rate of venous thromboembolism prophylaxis use by age and burn size; lighter blue colours represent a lower rate of prophylaxis administration while darker red colours represent a higher rate of prophylaxis use.

FIGURE 28 – Venous Thromboembolism Prophylaxis Use in Adult Burns by Age Group and Burn Size, 2016/17 to 2018/19



25 Pannucci CJ, Obi AT, Timmins BH et al. Venous thromboembolism in patients with thermal injury: A review of risk assessment tools and current knowledge of the effectiveness and risks of mechanical and chemical prophylaxis. Clinics in Plastic Surgery. 2017;44:573-581.

WEIGHT RECORDED AND WEIGHT LOSS

Weight loss following burn injury can affect patient outcomes in terms of healing potential and rehabilitation outcomes. Extended length of stay is associated with weight loss and associated poorer outcomes[26]. In severe burn injury, some degree of weight loss may be unavoidable. It is necessary to develop an understanding of treatment factors that minimise weight loss and the degree to which weight loss and loss of lean body mass is avoidable. The registry collects data on whether patients with a length of stay exceeding 14 days have their weight recorded within three to five days of their admission (to account for the significant fluctuations in weight due to fluid resuscitation within the initial 72 hours after injury) and whether their weight is then recorded on a weekly basis.

For paediatric patients with a length of stay exceeding two weeks during 2018/19, the weight was recorded within three to five days of admission in 92.3% of cases (an increase from 86.2% in 2017/18) and recorded on a weekly basis for 63.0% of cases (an increase from 50.0% in 2017/18). For adult cases, weight was recorded within three to five days of admission in 65.7% of cases (an increase from 62.3% in the previous reporting period) but on a weekly basis in only 39.3% of cases. Among older adult cases, 53.9% of cases were weight within three to five days and 33.3% were weighed on a weekly basis, decreases from 66.3% and 44.4% in the previous reporting period.

Where weight was recorded for paediatric patients in 2018/19, 20% of patients lost weight. The median amount of weight lost by paediatric patients in 2018/19 was 0.4kg.

Fifty-four percent of adult cases with a length of stay greater than two weeks lost weight; the median (and interquartile range) of lost weight was 5kg (2.3-8.9kg). Fifty-nine percent of older adult patients lost weight during admissions lasting longer than two weeks; the median amount of weight lost was 2kg.

26 Khorasani EN, Mansouri F. Effect of early enteral nutrition on morbidity and mortality in children with burns. Burns. 2010;36(7):1067-1071.

IN-HOSPITAL OUTCOMES FOLLOWING BURN INJURY

This section describes the hospital outcomes of burn care, including intensive care unit admissions, complications during the episode of care, length of stay, discharge disposition, and readmissions.

ICU ADMISSIONS

Critical care management and mechanical ventilation may be required after burn injury[27]. In comparison to the 2017/18 reporting period fewer patients were admitted to the intensive care unit during their hospital stay for both adult and paediatric cases. The proportion of paediatric cases with major burns being admitted to the intensive care unit increased from the previous reporting period, but the adult figure decreased over the same comparison period.

TABLE 29 – ICU Admissions by Age Group, Burn Severity, and Reporting Period, 2009/10 to 2018/19

	All Patients	Paediatric Patients (0-15 Years)	Major Paediatric Patients (0-15 Years)	Adult Patients (≥16 Years)	Major Adult Patients (≥16 Years)
2009/10	230 (10.6%)	32 (5.5%)	19 (59.4%)	198 (12.4%)	103 (67.3%)
2010/11	281 (11.3%)	43 (5.6%)	23 (51.1%)	238 (13.8%)	91 (65.5%)
2011/12	331 (11.8%)	47 (5.3%)	25 (53.2%)	284 (14.8%)	95 (65.1%)
2012/13	313 (11.3%)	33 (3.8%)	16 (39.0%)	280 (14.8%)	114 (70.8%)
2013/14	297 (10.5%)	42 (4.1%)	15 (29.4%)	255 (14.1%)	78 (72.2%)
2014/15	303 (11.0%)	45 (4.4%)	24 (52.2%)	258 (14.9%)	95 (72.0%)
2015/16	296 (10.2%)	47 (4.9%)	33 (57.9%)	247 (12.8%)	98 (71.0%)
2016/17	292 (8.8%)	42 (4.2%)	25 (45.5%)	250 (10.8%)	112 (65.5%)
2017/18	314 (9.1%)	30 (3.0%)	16 (39.0%)	284 (11.6%)	126 (72.8%)
2018/19	262 (8.0%)	32 (3.5%)	13 (43.3%)	230 (9.7%)	94 (61.8%)
TOTAL	**2,919 (10.2%)**	**393 (4.4%)**	**209 (47.0%)**	**2,524 (12.8%)**	**1,006 (68.3%)**

27 Palmieri TL. What's new in critical care of the burn-injured patient? Clinics in Plastic Surgery. 2009;36(4):607-615.
Wang Y, Tang HT, Xia ZF et al. Factors affecting survival in adult patients with massive burns. Burns. 2010;36(1):57-64.

ICU LENGTH OF STAY

The median (interquartile range) length of stay in the intensive care unit during 2018/19 for paediatric patients was 57.1 (26.9-210) hours, an increase from 55.8 (37.7-298.7) hours in 2017/18. The median (interquartile range) intensive care unit length of stay decreased for adults, falling from 66.8 (29.6-220.9) hours to 60 (23.7-214.2) hours in 2018/19.

TABLE 30 – Median and Interquartile Range of ICU LOS (in Hours) by Reporting Period, 2009/10 to 2018/19

	All Patients	Paediatric Patients (0-15 Years)	Adult Patients (≥16 Years)
2009/10	84.4 (36.9-281.1)	93.7 (33.1-298.1)	82.3 (36.9-276.7)
2010/11	64.5 (28.6-192.1)	44.0 (19.2-235.0)	66.2 (30.9-192.0)
2011/12	52.6 (23.5-184.6)	78.3 (17.8-294.0)	50.6 (24.9-177.6)
2012/13	66.7 (30.1-163.8)	39.7 (24.4-121.3)	70.0 (30.4-188.1)
2013/14	65.5 (31.3-153.5)	69.1 (27.5-192.0)	65.5 (31.5-143.3)
2014/15	54.9 (27.1-183.6)	49.4 (19.0-164.3)	55.8 (28.2-185.8)
2015/16	80.5 (33.3-219.6)	96.5 (39.0-392.8)	73.3 (30.8-190.8)
2016/17	60.0 (26.0-244.7)	70.8 (20.5-251.8)	59.0 (27.1-237.8)
2017/18	65.2 (31.5-228.7)	55.8 (37.7-298.7)	66.8 (29.6-220.9)
2018/19	59.5 (24.0-214.2)	57.1 (26.9-210.6)	60.0 (23.7-214.2)
TOTAL	**64.0 (28.2-204.5)**	**64.2 (23.5-235.9)**	**64.0 (29.0-195.8)**

MECHANICAL VENTILATION IN ICU

A greater proportion of adult patients admitted to the intensive care unit during 2018/19 were placed on a mechanical ventilator compared to paediatric patients (75.7% compared to 65.5%). This has been a consistent trend for each reporting period of the registry.

TABLE 31 – Rate of Mechanical Ventilation in ICU by Reporting Period and Adult Status, 2009/10 to 2018/19

	All Patients	Paediatric Patients (0-15 Years)	Adult Patients (≥16 Years)
2009/10	172 (75.4%)	21 (67.7%)	151 (76.6%)
2010/11	217 (77.2%)	28 (65.1%)	189 (79.4%)
2011/12	255 (77.0%)	32 (68.1%)	223 (78.5%)
2012/13	247 (78.9%)	25 (75.8%)	222 (79.3%)
2013/14	224 (75.7%)	26 (63.4%)	198 (77.6%)
2014/15	223 (73.6%)	27 (60.0%)	196 (76.0%)
2015/16	217 (73.8%)	29 (64.4%)	186 (75.3%)
2016/17	228 (78.4%)	28 (66.7%)	200 (80.3%)
2017/18	246 (79.9%)	19 (63.3%)	227 (81.7%)
2018/19	192 (74.4%)	21 (65.6%)	171 (75.7%)
TOTAL	**2,221 (76.5%)**	**256 (65.8%)**	**1,963 (78.1%)**

For the patients who were placed on a mechanical ventilator in the intensive care unit, the median (interquartile range) mechanical ventilation time during 2018/19 for paediatric patients was 43.3 (30.5-201.1) hours, a decrease from 94 (17.3-232.3) hours in 2017/18. The median (interquartile range) intensive care unit mechanical ventilation time also decreased in adults, falling from 43.3 (19.7-166) hours to 38.1 (15.7-173) hours in 2018/19.

TABLE 32 – Median Mechanical Ventilation Time (in Hours) by Reporting Period, 2009/10 to 2018/19

	All Patients	Paediatric Patients (0-15 Years)	Adult Patients (≥16 Years)
2009/10	81.0 (24.0-216.0)	143.0 (27.0-303.5)	72.0 (24.0-201.0)
2010/11	51.8 (19.5-156.0)	73.7 (21.0-265.0)	50.1 (19.0-145.0)
2011/12	40.0 (17.6-135.0)	69.0 (13.7-180.0)	39.0 (18.0-135.0)
2012/13	41.0 (16.0-120.0)	19.3 (15.0-59.2)	43.5 (16.1-124.2)
2013/14	44.0 (19.8-128.0)	93.4 (35.0-148.9)	41.0 (19.5-121.0)
2014/15	39.7 (18.0-146.0)	38.6 (16.0-110.7)	40.0 (19.0-153.0)
2015/16	53.8 (19.3-184.7)	122.2 (50.5-282.8)	47.8 (17.8-151.1)
2016/17	54.6 (19.2-225.4)	69.2 (22.5-251.1)	51.7 (19.0-213.2)
2017/18	43.7 (19.6-181.8)	94.0 (17.3-232.3)	43.3 (19.7-166.0)
2018/19	38.4 (16.0-174.8)	43.3 (30.5-201.1)	38.1 (15.7-173.0)
TOTAL	**45.6 (18.7-160.0)**	**61.8 (18.6-208.5)**	**44.0 (18.7-153.0)**

During 2018/19 patients who died in-hospital spent a longer period of time on a mechanical ventilator in the intensive care unit compared to patients who survived to discharge. This is consistent with a majority of previous reporting periods.

TABLE 33 – Median Mechanical Ventilation Time (in Hours) by Reporting Period and Mortality Status, 2009/10 to 2018/19

	Survivors	Deaths
2009/10	72.0 (24.0-205.0)	163.0 (84.0-436.5)
2010/11	49.8 (19.5-156.0)	79.0 (18.0-174.2)
2011/12	40.0 (19.0-135.0)	28.3 (7.0-143.0)
2012/13	38.6 (16.0-107.3)	86.0 (17.3-321.2)
2013/14	45.0 (20.0-132.0)	25.8 (13.5-112.0)
2014/15	38.6 (17.7-139.0)	138.8 (39.3-404.0)
2015/16	53.9 (19.3-182.0)	31.2 (21.0-341.9)
2016/17	64.1 (20.2-228.5)	37.6 (12.7-113.6)
2017/18	42.5 (19.5-181.8)	58.2 (20.0-307.8)
2018/19	38.0 (16.6-147.5)	115.3 (9.4-197.0)
TOTAL	**45.0 (19.0-153.6)**	**55.6 (17.3-197.0)**

HOSPITAL LENGTH OF STAY

The length of admission is associated with increased case complexity, and is impacted by treatment protocols[28]. All cases were included in the length of stay analysis. Since 2011/12 there has been a downwards trend in the overall hospital length of stay. This decrease may be explained by changes in workflow, where more patients are managed in the outpatient environment. In 2018/19 males had a longer hospital length of stay than females; this finding is consistent with the majority of previous reporting periods.

TABLE 34 – Median Length of Stay (in Days) by Reporting Period and Gender, 2009/10 to 2018/19

	All Patients	Males	Females
2009/10	4.9 (1.7-10.2)	5.0 (1.7-10.1)	4.6 (1.7-10.8)
2010/11	4.9 (2.0-11.1)	4.9 (1.9-11.5)	5.0 (2.1-10.8)
2011/12	5.1 (1.9-10.9)	5.4 (1.9-10.8)	4.6 (1.7-11.1)
2012/13	4.6 (1.8-10.0)	4.7 (1.8-10.0)	4.1 (1.8-10.1)
2013/14	3.9 (1.6-8.9)	4.0 (1.7-9.0)	3.7 (1.4-8.9)
2014/15	3.8 (1.5-9.0)	4.1 (1.7-9.5)	3.1 (1.2-7.8)
2015/16	3.3 (1.3-8.3)	3.4 (1.3-8.4)	3.2 (1.2-8.3)
2016/17	3.5 (1.2-8.8)	3.8 (1.3-9.4)	2.9 (1.1-7.6)
2017/18	3.9 (1.3-9.0)	4.1 (1.6-9.6)	3.2 (1.1-7.9)
2018/19	3.8 (1.5-9.1)	3.9 (1.6-9.6)	3.2 (1.2-8.4)
TOTAL	**4.0 (1.6-9.6)**	**4.2 (1.7-9.8)**	**3.7 (1.3-9.0)**

Adult patients had the lowest median hospital length of stay during 2018/19, followed by paediatric patients and older adult patients. Over the previous 10 reporting periods older adults have typically had the longest in-hospital length of stay compared to their younger counterparts.

TABLE 35 – Median Length of Stay (in Days) by Reporting Period and Age Group, 2009/10 to 2018/19

	All Patients	Paediatrics (0-16 Years)	Adults (16-64 Years)	Older Adults (≥65 Years)
2009/10	4.9 (1.7-10.2)	2.2 (0.9-6.0)	5.6 (2.1-10.8)	10.8 (6.0-20.0)
2010/11	4.9 (2.0-11.1)	2.9 (1.2-7.1)	5.8 (2.6-11.9)	10.9 (5.7-19.8)
2011/12	5.1 (1.9-10.9)	3.1 (1.3-8.8)	5.6 (2.0-11.1)	9.5 (3.7-19.4)
2012/13	4.6 (1.8-10.0)	2.8 (1.1-7.1)	4.9 (1.9-10.5)	9.2 (4.5-19.8)
2013/14	3.9 (1.6-8.9)	2.6 (1.0-7.0)	4.4 (2.0-9.1)	8.1 (3.9-16.8)
2014/15	3.8 (1.5-9.0)	2.6 (1.0-6.3)	4.4 (1.8-9.8)	7.9 (3.9-15.0)
2015/16	3.3 (1.3-8.3)	2.5 (1.0-6.1)	3.8 (1.5-8.8)	7.1 (2.8-15.9)
2016/17	3.5 (1.2-8.8)	2.0 (0.9-5.2)	3.9 (1.3-9.0)	9.0 (3.8-15.7)
2017/18	3.9 (1.3-9.0)	2.2 (0.8-6.0)	4.2 (1.7-9.5)	8.6 (2.9-15.9)
2018/19	3.8 (1.5-9.1)	2.1 (0.9-5.8)	4.1 (1.7-9.6)	8.5 (3.2-17.9)
TOTAL	**4.0 (1.6-9.6)**	**2.6 (1.0-6.6)**	**4.6 (1.8-10.0)**	**8.8 (3.8-17.2)**

Burns exceeding 50% TBSA had substantially longer length of stays compared to patients with smaller burns.

28 Pereira C, Murphy K, Herndon D. Outcome measures in burn care. Is mortality dead? Burns. 2004;30(8):761-771.

TABLE 36 – Median Length of Stay by Reporting Period and %TBSA Group, 2009/10 to 2018/19

	All Patients	0-9%	10-19%	20-49%	≥50%
2009/10	4.9 (1.7-10.2)	3.6 (1.4-7.8)	11.3 (6.1-17.8)	23.0 (13.7-41.9)	18.4 (0.8-82.7)
2010/11	4.9 (2.0-11.1)	3.9 (1.7-8.6)	11.5 (5.6-19.0)	23.0 (16.1-36.7)	50.7 (4.5-79.9)
2011/12	5.1 (1.9-10.9)	4.0 (1.7-8.8)	11.6 (6.8-18.8)	22.5 (14.1-37.3)	34.3 (0.4-78.8)
2012/13	4.6 (1.8-10.0)	3.7 (1.6-7.5)	10.0 (5.1-16.9)	22.9 (13.5-40.6)	19.5 (0.8-73.3)
2013/14	3.9 (1.6-8.9)	3.2 (1.3-6.9)	10.8 (6.3-16.8)	24.5 (13.5-38.2)	2.3 (0.7-50.5)
2014/15	3.8 (1.5-9.0)	3.0 (1.2-6.8)	12.1 (5.9-17.8)	22.6 (13.9-36.8)	29.7 (0.8-82.5)
2015/16	3.3 (1.3-8.3)	2.8 (1.1-6.3)	10.0 (4.6-17.1)	23.0 (15.3-45.2)	32.4 (1.1-97.1)
2016/17	3.5 (1.2-8.8)	2.8 (1.1-6.9)	10.6 (4.0-15.9)	21.5 (14.7-37.8)	38.8 (0.7-89.5)
2017/18	3.9 (1.3-9.0)	2.9 (1.1-6.9)	11.6 (6.5-18.3)	21.2 (14.9-39.0)	27.7 (1.6-81.9
2018/19	3.8 (1.5-9.1)	2.9 (1.2-6.9)	11.9 (6.6-19.4)	24.7 (15.6-46.5)	27.4 (2.7-68.6)
TOTAL	**4.0 (1.6-9.6)**	**3.1 (1.2-7.1)**	**11.1 (5.7-17.8)**	**22.9 (14.7-39.3)**	**29.0 (0.9-81.9)**

Patients who perished in hospital during 2018/19 had a longer length of stay compared to patients who survived to discharge. This is in contrast to the previous two reporting periods, where surviving patients had a longer length of stay.

TABLE 37 – Median Length of Stay by Reporting Period and Mortality Status, 2009/10 to 2018/19

	All Patients	Survived	Died
2009/10	4.9 (1.7-10.2)	4.9 (1.7-10.1)	5.6 (0.5-16.4)
2010/11	4.9 (2.0-11.1)	4.9 (2.0-11.1)	3.6 (0.8-9.2)
2011/12	5.1 (1.9-10.9)	5.1 (1.9-10.9)	2.3 (0.3-18.6)
2012/13	4.6 (1.8-10.0)	4.6 (1.8-10.0)	6.0 (0.7-15.8)
2013/14	3.9 (1.6-8.9)	3.9 (1.6-8.9)	1.5 (0.7-11.1)
2014/15	3.8 (1.5-9.0)	3.8 (1.5-8.9)	5.8 (0.7-18.1)
2015/16	3.3 (1.3-8.3)	3.2 (1.3-8.1)	5.8 (0.8-22.4)
2016/17	3.5 (1.2-8.8)	3.5 (1.2-8.8)	2.3 (0.6-12.5)
2017/18	3.9 (1.3-9.0)	3.9 (1.3-9.0)	3.1 (0.8-15.9)
2018/19	3.8 (1.5-9.1)	3.8 (1.5-9.1)	5.3 (0.7-15.3)
TOTAL	**4.0 (1.6-9.6)**	**4.0 (1.6-9.6)**	**4.0 (0.7-14.7)**

In adult patients, the predicted length of stay by %TBSA for burns between ten and 50% is one day per %TBSA burned[29]. Figure 29 shows the relationship between the size of the burn and the mean length of stay, increasing in one percent units of burn size, in adults over the previous ten reporting periods. The error bars represent the standard deviation of the length of stay, while the blue line represents the expected length of stay based on the one day per percentage of TBSA burned theory. For the majority of cases the registry data is consistent with the notion of the length of stay increasing by one day for each additional percentage of body surface area burned.

FIGURE 29 – Burn Size and Mean Length of Stay in Adult Burn Patients, 2009/10 to 2018/19

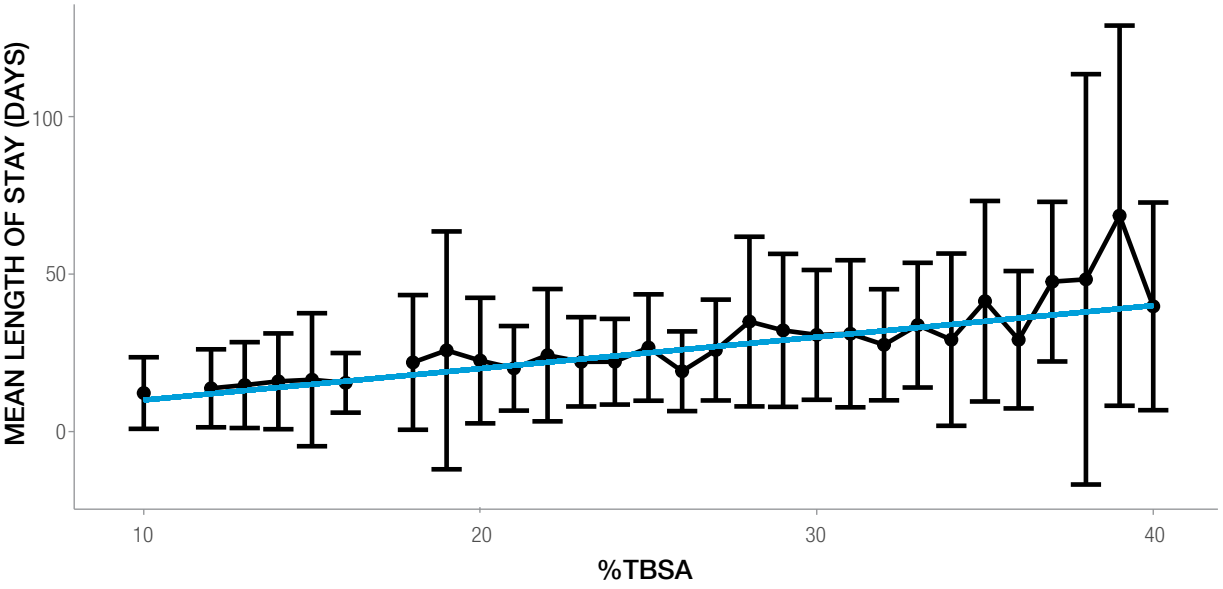
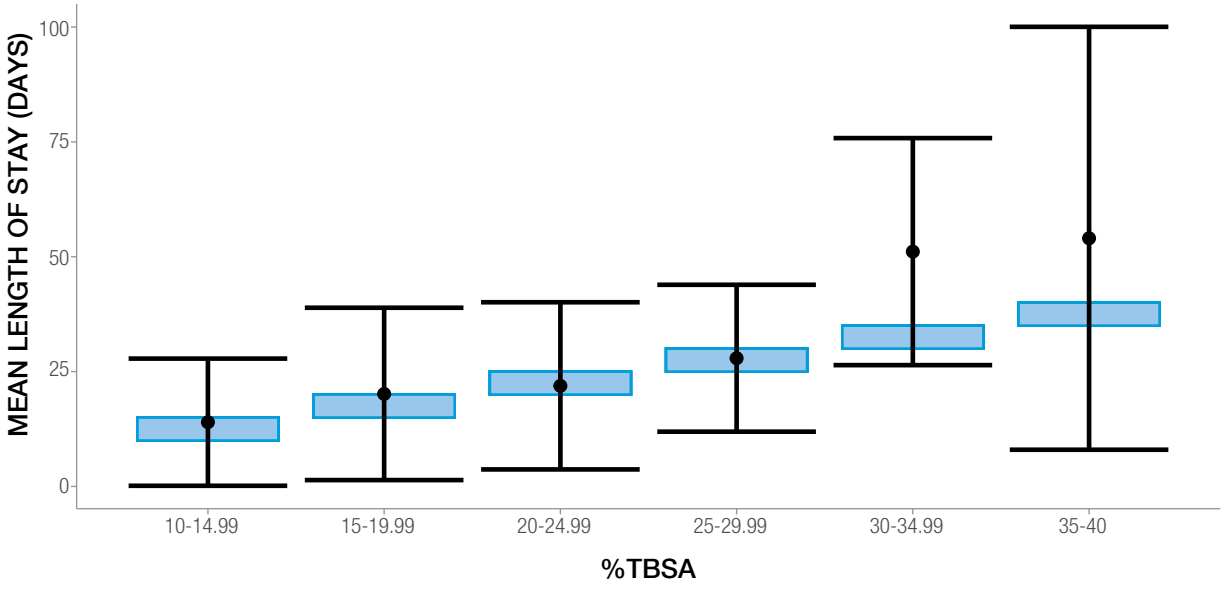


Figure 30 shows the relationship between the size of the burn and the mean length of stay, increasing in five percent units of burn size, in adults over the past year. The error bars represent the standard deviation of the length of stay, while the blue rectangles represent the predicted length of stay based on the one day per percentage of TBSA burned theory. During 2018/19 the median length of stay fell within the 'target' range for burns under 30% TBSA, at which point the in-hospital length of stay exceeded the 'target' range.

FIGURE 30 – Burn Size Groups and Mean Length of Stay in Adult Burn Patients, 2018/19



29 Related to Gillespie R, Carroll W, Dimick AR, et al. Diagnosis-related groupings (DRGs) and wound closure: Roundtable discussion. Journal of Burn Care & Rehabilitation. 1987;8:199-209.

DISCHARGE DISPOSITION (FOR PATIENTS SURVIVING TO DISCHARGE)

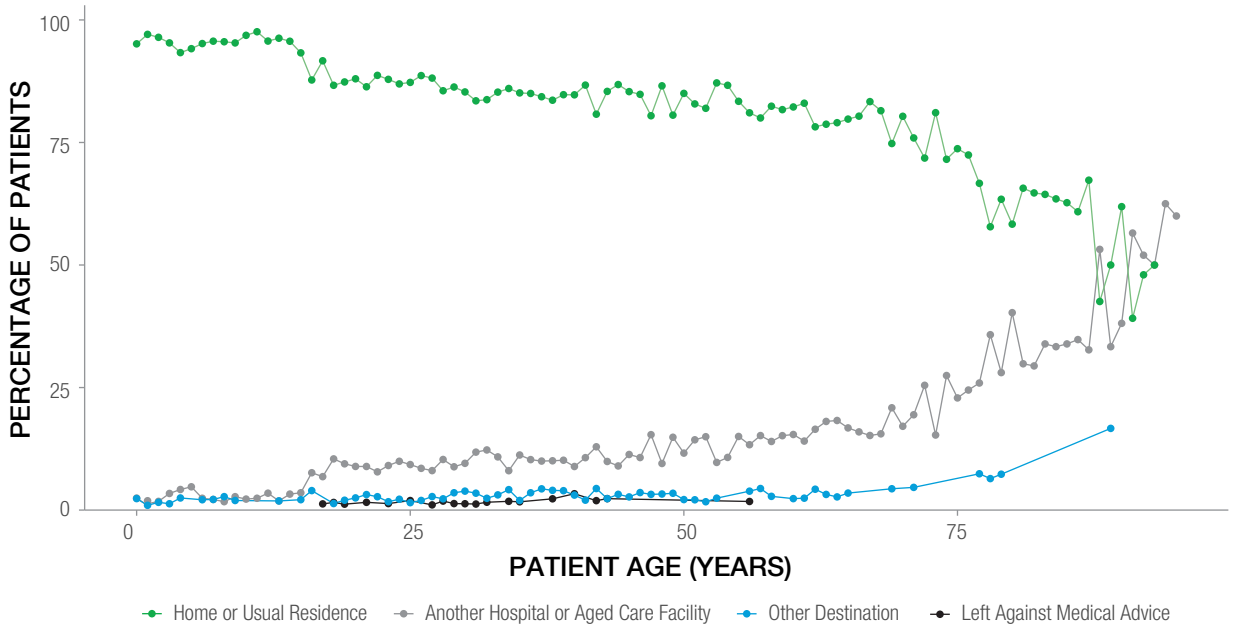
Most patients were discharged to their home or usual place of residence during the 2018/19 reporting period (Table 38). This observation has been consistent for the duration of the registry. Very few patients (~1% per year) discharge against medical advice.

TABLE 38 – Discharge Disposition for Surviving BRANZ Patients by Reporting Period, 2009/10 to 2018/19

	Home or Usual Place of Residence	Another Hospital or Healthcare Facility	Left Against Medical Advice	Other Destination
2009/10	1,796 (83.7%)	258 (12.0%)	21 (1.0%)	72 (3.4%)
2010/11	2,121 (86.0%)	227 (9.2%)	22 (0.9%)	97 (3.9%)
2011/12	2,415 (86.8%)	269 (9.7%)	24 (0.9%)	73 (2.6%)
2012/13	2,347 (85.7%)	316 (11.5%)	15 (0.6%)	61 (2.2%)
2013/14	2,493 (88.6%)	254 (9.0%)	12 (0.4%)	55 (2.0%)
2014/15	2,478 (89.9%)	225 (8.2%)	16 (0.6%)	37 (1.3%)
2015/16	2,564 (89.8%)	226 (7.9%)	23 (0.8%)	42 (1.5%)
2016/17	2,881 (88.1%)	308 (9.4%)	30 (0.9%)	50 (1.5%)
2017/18	3,009 (87.7%)	310 (9.0%)	21 (0.6%)	93 (2.7%)
2018/19	2,804 (86.2%)	304 (9.4%)	37 (1.1%)	107 (3.3%)
TOTAL	**24,908 (87.4%)**	**2,697 (9.5%)**	**221 (0.8%)**	**687 (2.4%)**

The proportion of patients discharged to their home or usual place of residence declined with age (Figure 31). This decline was accounted for by an increasing proportion of patients being discharged to another hospital or healthcare facility. Age-disposition combinations occurring less than five times were excluded to enhance the clarity of the figure.

FIGURE 31 – Discharge Disposition for Surviving BRANZ Patients by Age, 2009/10 to 2018/19



IN-HOSPITAL DEATHS

In-hospital deaths following burn injury are uncommon in developed countries such as Australia and the United States. Less than one percent of patients died in-hospital during the 2018/19 reporting period, a slight decline compared to the 2017/18 reporting period (Table 39). There was a greater decline in the in-hospital mortality rate in female patients compared to males for the 2018/19 reporting period.

TABLE 39 – In-Hospital Deaths for Registered BRANZ Patients by Reporting Period, Gender, and Indigenous Status, 2009/10 to 2018/19

	All Patients	Male	Female	Non-Indigenous Australian	Indigenous Australian
2009/10	35 (1.6%)	19 (1.3%)	16 (2.4%)	26 (1.8%)	0 (0.0%)
2010/11	19 (0.8%)	14 (0.8%)	5 (0.6%)	8 (0.5%)	* (1.5%)
2011/12	31 (1.1%)	19 (1.0%)	12 (1.3%)	15 (0.8%)	0 (0.0%)
2012/13	36 (1.3%)	20 (1.1%)	16 (1.8%)	16 (0.9%)	* (0.7%)
2013/14	29 (1.0%)	19 (1.0%)	10 (1.1%)	14 (0.8%)	* (0.7%)
2014/15	23 (0.8%)	11 (0.6%)	12 (1.3%)	6 (0.4%)	0 (0.0%)
2015/16	36 (1.3%)	22 (1.1%)	14 (1.5%)	14 (0.8%)	* (1.8%)
2016/17	51 (1.5%)	31 (1.4%)	20 (1.9%)	30 (1.3%)	5 (2.8%)
2017/18	37 (1.1%)	25 (1.1%)	12 (1.1%)	24 (1.0%)	* (1.5%)
2018/19	28 (0.9%)	20 (0.9%)	8 (0.7%)	15 (0.7%)	* (1.1%)
TOTAL	**325 (1.1%)**	**200 (1.0%)**	**125 (1.3%)**	**168 (0.9%)**	**17 (1.1%)**

In-hospital deaths for paediatric patients were particularly rare, with many reporting periods not registering a single event (Table 40). Paediatric and adult in-hospital mortality decreased from the previous reporting period. The proportion of patients dying in-hospital following burn injury increased with age.

TABLE 40 – In-Hospital Deaths for Registered BRANZ Patients by Reporting Period and Age Group, 2009/10 to 2018/19

	All Patients	Paediatric Patients (0-15 Years)	Adult Patients (16-64 Years)	Older Adult Patients (≥65 Years)
2009/10	35 (1.6%)	* (0.3%)	20 (1.4%)	13 (7.3%)
2010/11	19 (0.8%)	* (0.4%)	12 (0.8%)	4 (2.2%)
2011/12	31 (1.1%)	* (0.1%)	13 (0.8%)	17 (6.8%)
2012/13	36 (1.3%)	0 (0.0%)	23 (1.4%)	13 (5.5%)
2013/14	29 (1.0%)	0 (0.0%)	17 (1.1%)	12 (5.1%)
2014/15	23 (0.8%)	0 (0.0%)	10 (0.7%)	13 (5.6%)
2015/16	36 (1.3%)	0 (0.0%)	22 (1.3%)	14 (5.5%)
2016/17	51 (1.5%)	* (0.3%)	26 (1.3%)	22 (6.6%)
2017/18	37 (1.1%)	* (0.1%)	26 (1.2%)	10 (3.0%)
2018/19	28 (0.9%)	0 (0.0%)	12 (0.6%)	16 (4.8%)
TOTAL	**325 (1.1%)**	**10 (0.1%)**	**181 (1.1%)**	**134 (5.2%)**

The proportion of patients who died generally increased with burn size. Less than one percent of patients with a burn under 10% TBSA died in the 2018/19 reporting period (Table 41). In contrast, approximately a third of patients with a burn exceeding 50% TBSA died in the most recent reporting period, a drop from the 53.3% in the previous reporting period.

TABLE 41 – In-Hospital Deaths for Registered BRANZ Patients by Reporting Period and %TBSA Category, 2009/10 to 2018/19

	All Patients	0-9% TBSA	10-19% TBSA	20-49% TBSA	≥ 50% TBSA
2009/10	35 (1.6%)	* (0.2%)	* (0.8%)	8 (6.2%)	22 (56.4%)
2010/11	19 (0.8%)	5 (0.3%)	* (0.6%)	* (1.5%)	10 (41.7%)
2011/12	31 (1.1%)	8 (0.3%)	* (0.6%)	7 (5.2%)	14 (35.0%)
2012/13	36 (1.3%)	6 (0.3%)	* (0.9%)	7 (4.6%)	20 (54.1%)
2013/14	29 (1.0%)	* (0.1%)	6 (1.9%)	8 (7.7%)	13 (61.9%)
2014/15	23 (0.8%)	* (0.2%)	* (0.7%)	8 (6.4%)	9 (32.1%)
2015/16	36 (1.3%)	7 (0.3%)	* (1.3%)	* (3.1%)	21 (47.7%)
2016/17	51 (1.5%)	15 (0.5%)	6 (1.8%)	8 (5.1%)	22 (42.3%)
2017/18	37 (1.1%)	5 (0.2%)	* (1.1%)	* (2.7%)	24 (53.3%)
2018/19	28 (0.9%)	6 (0.2%)	6 (1.8%)	7 (5.1%)	9 (34.6%)
TOTAL	**325 (1.1%)**	**61 (0.3%)**	**37 (1.2%)**	**63 (4.7%)**	**164 (45.9%)**

The registry records the reason for death for patients who die in-hospital. Multi-system organ failure has been the most common reason for death since the launch of the registry, with burns shock the second most common reason for death (Table 42).

TABLE 42 – Reason for Death in Registered BRANZ Patients, 2009/10 to 2018/19

	N (%)
Multi-System Organ Failure	115 (38.2%)
Burns Shock	70 (23.3%)
Other Cause (Specify)	39 (13.0%)
Sepsis	23 (7.6%)
Cardiac (AMI)	17 (5.7%)
Pulmonary (PE, Pneumonia, ARDS)	17 (5.7%)
Cerebrovascular (Stroke)	9 (3.0%)
Renal (Acute Renal Failure)	6 (2.0%)
Haemorrhage (Blood Loss/Exsanguinations)	* (1.3%)
Haematological (DIC)	* (< 1%)

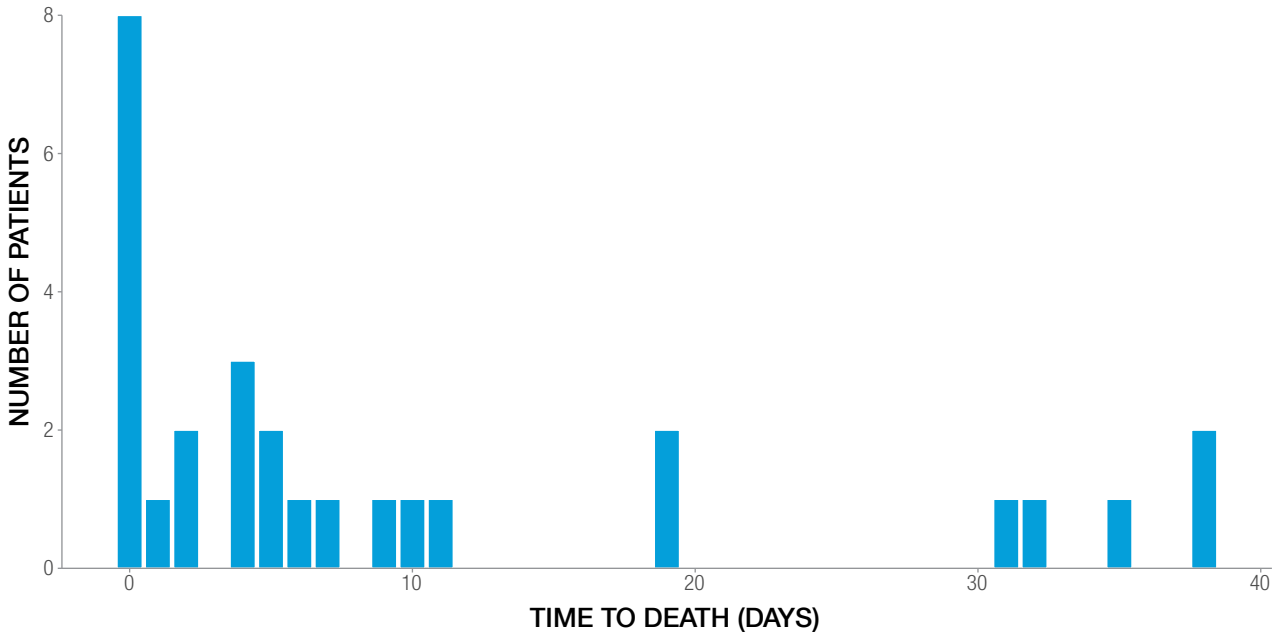
Of the patients who died during their hospital stay during the 2018/19 reporting period, active treatment was not commenced for 64.5%, an increase from the previous reporting period. There were noticeable changes from the previous reporting period to the current reporting period in the proportion of patients who received active treatment initially (before palliation) and the proportion of patients who received active treatment until the time of death.

TABLE 43 – Treatment Decision for Registered BRANZ Patients Who Died During Their Hospital Stay by Reporting Period, 2016/17 to 2018/19

	Palliative Management	Active Treatment P rior to Palliation	Active Treatment Until Death
2016/17	23 (47.9%)	18 (37.5%)	7 (14.6%)
2017/18	19 (55.9%)	13 (38.2%)	* (5.9%)
2018/19	16 (61.5%)	5 (19.2%)	5 (19.2%)
TOTAL	**58 (53.7%)**	**36 (33.3%)**	**14 (13.0%)**

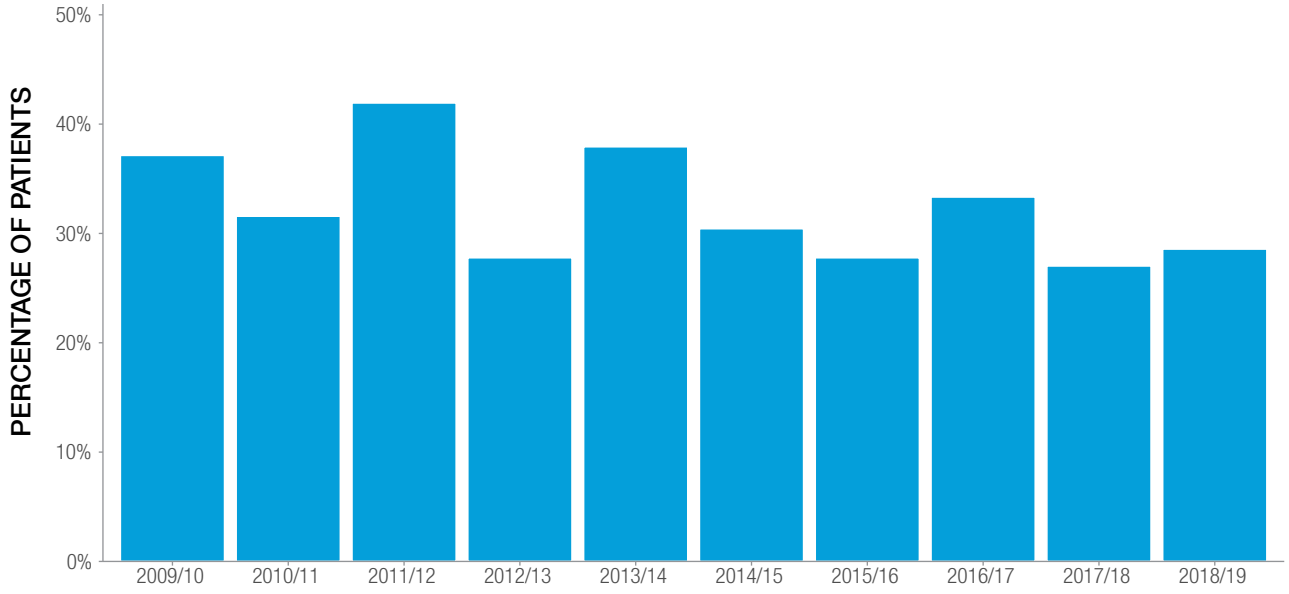
For patients who died in-hospital and where the length of stay was known, 29% of patients during the 2018/19 reporting period died within 24 hours of admission.

FIGURE 32 – Time to Death, 2018/19



While this is a slight increase from the previous reporting period, there has been a downwards trend in the proportion of patients dying within 24 hours of admission over the duration of the registry.

FIGURE 33 – Proportion of Patients Dying Within 24 Hours of Admission by Reporting Period, 2009/10 to 2018/19

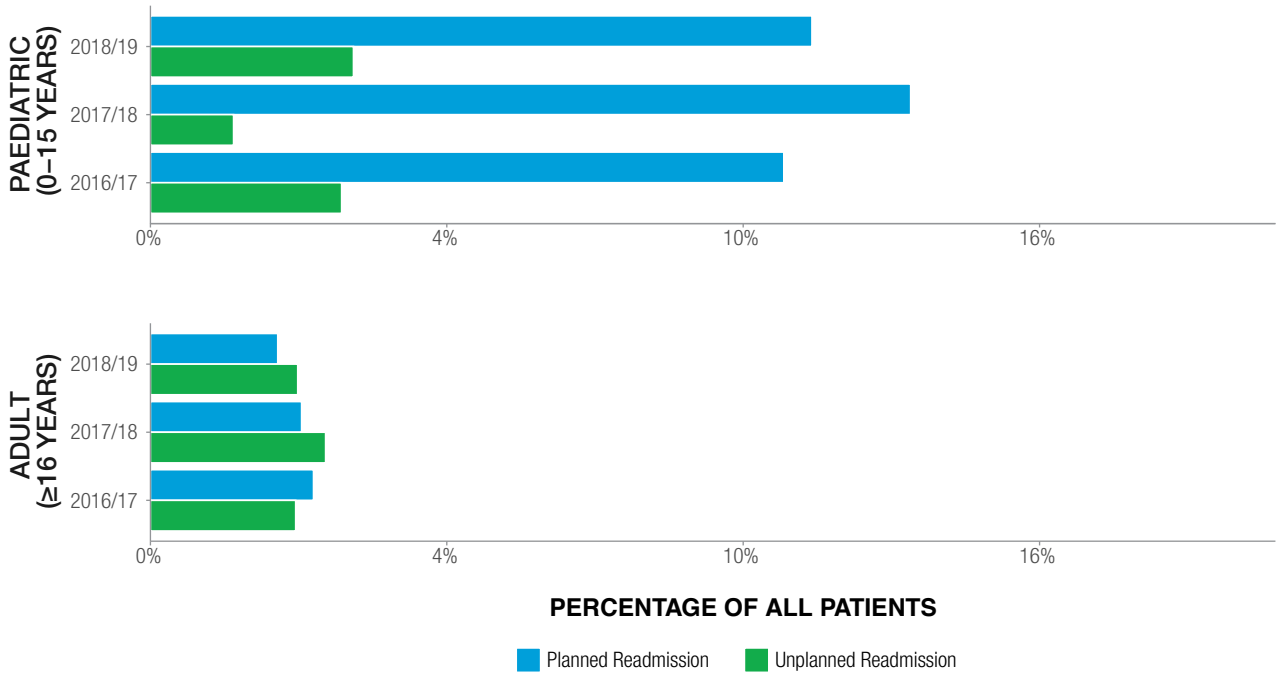


READMISSIONS

A total of 132 paediatric cases (14.6%) were readmitted within 28 days of discharge with the majority of these cases (76.5%) reported as being a planned readmission. This figure is consistent with previous reporting periods. This is reflective of the common practice for paediatric patients to be discharged early and readmitted for planned acute burn wound management procedures such as skin grafting.

Consistent with past reporting periods, the readmission rate was lower for adults. Only 4.9% of adult cases experienced a readmission within 28 days of discharge. In contrast to the paediatric patients, 46% of these cases were reported as 'unplanned' for wound healing issues or wound infection. For adult cases, it is more typical for patients to remain as inpatients until the majority of the acute burn wound management procedures are completed. Fewer cases have planned readmissions for acute burn management procedures. This outcome quality indicator was developed to identify cases where the readmission was unplanned, or arose from an unexpected complication. We hope that poor outcomes in terms of readmission may be able to be linked to processes of care, which can be improved in the future.

FIGURE 34 – Readmission Status by Age Group and Reporting Period, 2016/17 to 2018/19



APPENDICES

APPENDIX A FIGURE AND TABLE HEADERS

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APPENDIX B INVESTIGATORS AND STAFF

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Carl Lisec
Tracey Perrett
Linda Quinn
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Fiona Wood

APPENDIX C HOSPITALS WITH ETHICS COMMITTEE APPROVAL

Collection of potentially re-identifiable patient level data from each of the hospitals and health services is conducted under strict National Health and Medical Research Council guidelines and national and Victorian privacy legislation. Ethics committee approval for the registry was obtained from Monash University Human Research Ethics Committee.

Approval for burns data collection has also been actively sought from all BRANZ hospitals. All 17 specialist burns units have ethics approval to submit data to BRANZ and the remaining site. For this reporting period, 17 sites contributed data. Of these sites, five sites treat paediatric patients only, six sites treat adult patients only, and six sites treat both paediatric and adult patients.

Service	Location	Treats
The Alfred Hospital	Melbourne, Victoria	Adults
The Royal Children's Hospital	Melbourne, Victoria	Paediatrics
Perth Children's Hospital	Western Australia	Paediatrics
Fiona Stanley Hospital	Perth, Western Australia	Adults
Royal North Shore Hospital	New South Wales	Adults
Concord General Repatriation Hospital	New South Wales	Adults
Children's Hospital at Westmead	New South Wales	Paediatrics
Women's & Children's Hospital	Adelaide, South Australia	Paediatrics
Royal Adelaide Hospital	Adelaide, South Australia	Adults
Royal Brisbane and Women's Hospital	Queensland	Adults
Queensland Children's Hospital	Queensland	Paediatrics
Royal Hobart Hospital	Hobart, Tasmania	Adults & Paediatrics
Royal Darwin Hospital	Darwin, Northern Territory	Adults & Paediatrics
Middlemore Hospital	Auckland, New Zealand	Adults & Paediatrics
Christchurch Hospital	Christchurch, New Zealand	Adults & Paediatrics
Waikato Hospital	Hamilton, New Zealand	Adults & Paediatrics
Hutt Hospital	Hutt, New Zealand	Adults & Paediatrics

APPENDIX D PUBLICATIONS AND PRESENTATION LIST FOR 2018/19

During the 2018/19 reporting period, BRANZ data was presented in the following articles and conference presentations. Note that some reports, publications, and presentations listed below may overlap with prior or subsequent annual reports given that outputs may be accepted and then finalised (published/presented) across subsequent financial years.

ARTICLES

McInnes, J.A., Cleland, H.A., Cameron, P.A., Darton, A., Tracy, L.M., Wood, F.M., Singer, Y., & Gabbe, B.J. (2019). Epidemiology of burn-related fatalities in Australia and New Zealand, 2009-2015. Burns, 45(7):1553-1561.

McInnes, J.A., Cleland, H., Tracy, L.M., Darton, A., Wood, F.M., Perrett, T., & Gabbe, B.J. (2019) Epidemiology of work-related burn injuries presenting to burn centres in Australia and New Zealand. Burns 45(2): 484-493.

CONFERENCE PRESENTATIONS

Singer, Y., Cleland, H., Gabbe, B.J., & Tracy, L.M. Quality and outcome measures in burn care: An Australian and New Zealand perspective [Plenary presentation]. 19th Congress of the International Society for Burn Injuries, New Delhi, India. 30 November – 4 December 2018.

Singer, Y., Tracy, L.M., Bessey, P.Q., Peck, M.D., Phillips, B., McInnes, J., Cleland, H., & Gabbe, B.J. Benchmarking across the Pacific [Oral Presentation]. 19th Congress of the International Society for Burn Injuries, New Delhi, India. 30 November – 4 December 2018.

Singer, Y., Padiglioni, A., Tracy, L.M., Gabbe, B.J., Perret, T., Cleland, H., & Raby, E. Positive blood cultures in a burn cohort, epidemiology and outcomes: Findings from the Burns Registry of Australia and New Zealand [Oral Presentation]. 19th Congress of the International Society for Burn Injuries, New Delhi, India. 30 November – 4 December 2018.

Ryder, C., Mackean, T., Hunter, K., Moller, H., Gabbe B., Holland, A., & Ivers, R. Burden of Burns in Australian Children [Oral Presentation]. 42nd Annual Scientific Meeting of the Australian and New Zealand Burn Association, Brisbane, Australia. 16 – 19 October 2018.

Tracy, L.M., Singer, Y., McInnes, J.A., & Gabbe, B.J. on behalf of the BRANZ HCF Project Advisory Committee. HCF BRANZ & BQIP Project Workshop [Workshop Presentation]. 42nd Annual Scientific Meeting of the Australian and New Zealand Burn Association, Brisbane, Australia. 16 – 19 October 2018.

McInnes, J.A., Cleland, H., Tracy, L.M., Darton, A., Wood, F.M., Perrett, T., & Gabbe, B.J. Epidemiology of work-related burn injuries presenting to burn centres in Australia and New Zealand [Oral Presentation]. 42nd Annual Scientific Meeting of the Australian and New Zealand Burn Association, Brisbane, Australia. 16 – 19 October 2018.

Tracy, L.M. on behalf of the BRANZ HCF Project Advisory Committee. BRANZ Burns Quality Improvement Program Update [Forum Presentation]. 42nd Annual Scientific Meeting of the Australian and New Zealand Burn Association, Brisbane, Australia. 16 – 19 October 2018.

Tracy, L.M., Singer, Y., Gong J., Cleland, H., Cameron, P.A., Wood, F., Perrett, T., & Gabbe, B.J. on behalf of the BRANZ HCF Project Advisory Committee. BQIP: Delivering improved burn care through registry data [Oral Presentation]. 42nd Annual Scientific Meeting of the Australian and New Zealand Burn Association, Brisbane, Australia. 16 – 19 October 2018.

Tracy, L.M., Singer, Y., Bessey, P.Q., Peck, M.D., Phillips, B., McInnes, J., Cleland, H., & Gabbe, B.J. Benchmarking burn data across the Pacific [Oral Presentation]. 42nd Annual Scientific Meeting of the Australian and New Zealand Burn Association, Brisbane, Australia. 16 – 19 October 2018.

Tracy, L.M., Edgar, D.W., Schrale, R., Cleland, H., & Gabbe, B.J. Predictors of moderate to severe itch 12 months following admission to hospital for burn injury [Oral Presentation]. 42nd Annual Scientific Meeting of the Australian and New Zealand Burn Association, Brisbane, Australia. 16 – 19 October 2018.

APPENDIX E CRITERIA FOR SPECIALISED BURNS TREATMENT

The following criteria are endorsed by the Australian & New Zealand Burn Association in assessing whether burns require treatment in a specialised burns unit (ANZBA 2004):

- Burns greater than 10% of total body surface area (TBSA);
- Burns greater than 5% TBSA in children;
- Full-thickness burns greater than 5% TBSA;
- Burns to special areas (i.e., face, hands, feet, genitalia, perineum, and major joints);
- Electrical burns;
- Chemical burns;
- Burns with an association inhalation injury;
- Circumferential burns of the limbs or chest;
- Burns in the very young, very old, or pregnant;
- Burns in people with pre-existing medical disorders that could complicate management, prolong recovery, or increase mortality;
- Burns associated with major trauma; and
- Non-accidental burns

MONASH University

Burns Registry of Australia and New Zealand, Monash University

Requests for information from the registry are welcome.

Requests should be made to:

Burns Registry of Australia and New Zealand
Pre-Hospital Emergency and Trauma Research Unit
School of Public Health and Preventive Medicine

Monash University
553 St Kilda Rd, Melbourne Vic 3004
Phone: +61 3 9903 0288
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monash.edu/medicine/sphpm/branz

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