ANNUAL REPORT

1st July 2016 – 30th June 2017

BRANZ

Burns Registry of Australia and New Zealand

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Foreword

We are pleased to present the BRANZ 8th Annual report, which covers the reporting period from 1 July 2016 to 30 June 2017. The BRANZ captures clinical and outcomes data for admissions to all of the 17 specialist burn units in Australia and New Zealand: 15 of these 17 sites have contributed data since July 2009, with the remaining sites added in 2015 and 2016. The registry covers a combined population of 27.6 million people; and between July 2009 and June 2017 has captured 21,996 new burn admissions.

Because of the centralised nature of burn care in ANZ, the registry has clinical and outcome information for virtually all patients admitted to specialist units, and this is a source of powerful information that informs prevention campaigns, supports research, and informs quality improvement activities.

A recent study using BRANZ data has indicated there are large variations in burns care delivery and in treatment outcomes between units. This year we have secured funding from the HCF Research Foundation to further quantify variation in practice and the impact of this variation on outcome. This multi-centre study will use the high quality clinical data captured by BRANZ to evaluate the association between aspects of care and outcome. Study findings will drive the refinement of quality indicators used by BRANZ for monitoring quality of clinical care, and the development of new guidelines for burn care. The close association of ANZBA and BRANZ is a key strength of the Registry, and ensures a consensus approach to implementing study findings to address unnecessary and potentially harmful variation in burn care.

This year has also seen progress in the development of international collaborations: we are currently working with the American Burn Association to harmonise data in the US National Burn Repository with BRANZ. The Norwegian version of BRANZ will go live this year. Such collaborations will form the basis for an international co-operative effort to improve the standard of burn care through benchmarking for quality improvement.

BRANZ is a world leading clinical quality registry in burn care, which continues with the support of clinicians and academics to develop and underpin the provision of best practice burn care across Australia and New Zealand.

We commend this latest report to you.

Heather Cleland

Chair
BRANZ Steering Committee

Jeremy Rawlins

President
Australian and New Zealand Burn Association

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Executive Summary

This is the eighth annual report from the Burns Registry of Australia and New Zealand (BRANZ). BRANZ provides valuable information on the incidence and aetiology of burn injury across Australia and New Zealand. The registry collects epidemiological data on all burn patients admitted to BRANZ hospitals who meet the inclusion criteria. These data make it possible to monitor burn injury incidence and improve our understanding of burn causation. The data can be used to develop targeted prevention campaigns and to identify objective and verifiable data on treatment, outcomes and quality of care in burn injury management. The overall goal of BRANZ is to encourage higher standards of both burn injury prevention and patient care. Improvements are continuously made to the database as required to enhance data capture and quality.

Data are presented for 3,295 burns patients treated at 17 specialist burn units over the 12-month period from 1st July 2016 to 30th June 2017. Adults represented 70 per cent of all cases, and males accounted for 67 per cent of all cases. Children aged 1 to 2 years accounted for 33 per cent of paediatric cases, while 20 to 29 year olds accounted for 25 per cent of adult cases. Scalds (36 per cent) and flame burns (33 percent) were the primary cause of burn injury. Scald burns were the predominant cause for paediatric patients accounting for 57 per cent of all burns. For adults, flame burn was the predominant cause (43 per cent). The vast majority of burns (93 per cent) were considered to have been sustained during unintentional events.

A burn cooling intervention was provided at the scene of injury in 75 per cent of cases, and an adequate intervention (minimum of 20 minutes running cool water within three hours of the injury) was provided in 76 per cent of these cases. The median (IQR) time from injury to admission to a BRANZ hospital was 19 (3-165) hours for paediatric cases and 18 (4-108) hours for adult cases. A burn of less than 10 per cent total body surface area (TBSA) was recorded for 84 per cent of cases. Seventy-seven percent of all cases underwent a burn wound management procedure in theatre and, 61 percent of cases required skin grafting. The median (IQR) length of stay (LOS) was 3 (2-8) days for paediatric cases and 6 (3-12) days for adult cases (excluding deaths and LOS less than 24 hours). Less than two per cent of all cases died in-hospital and the majority of cases (87 per cent) were discharged to their usual residence. Fourteen per cent of paediatric cases were readmitted within 28 days of discharge, with the majority of these cases (77 per cent) reported as planned readmissions. A readmission was also recorded for five per cent of adult cases, however, nearly half of these were unplanned (49 per cent).

The hospital process and quality of care data presented in this report provides a baseline from which it is possible to make comparisons between centres and future monitoring of care can be undertaken. In 2016, BRANZ completed a review of quality indicators and on July 1 2016, new and updated quality indicator variables were added to the database. New quality indicator variables include whether an accepted diagram (such as the rule of nine) was used to calculate the per cent of TBSA and screening of nutritional status.

About this report

This is the eighth annual report of the Burns Registry of Australia and New Zealand (BRANZ). Data collected between the 1st July 2016 and 30th June 2017 (Year 8) is summarised in this report. All 17 BRANZ sites (13 Australian sites and 4 New Zealand sites) contributed data with 3,295 cases entered.

The sites that participated had Institutional Ethics Committee (IEC) approval and local resources for data collection that enabled them to contribute data to the registry. Of the seventeen BRANZ sites that contributed to this report, five sites treat paediatric patients only, six sites treat adult patients only, and six sites treat both paediatric and adult patients.

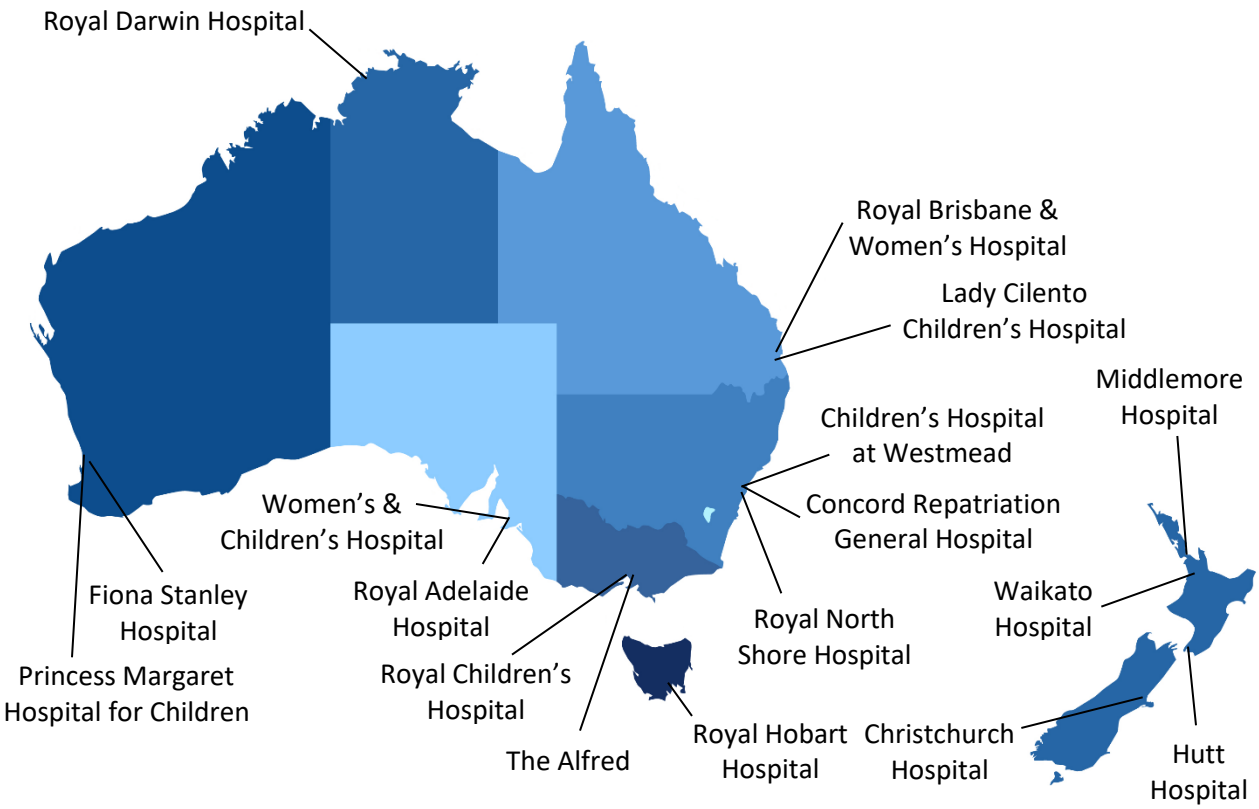
The report describes the registry, as well as the profile, treatment and outcomes of burns unit admissions from 1st July 2016 to 30th June 2017. Quality of care data related to processes of care is also provided. Where appropriate, data has been compared to previous annual report periods. Data has also been compared with the American Burn Association's National Burn Repository (NBR) 2016 (1) report of data from 2006 to 2015, as that the NBR reports comparable summary data.

About Burns Registry of Australia and New Zealand (BRANZ)

What is Burns Registry of Australia and New Zealand?

The Australian and New Zealand Burns Association (ANZBA) was formed in 1976 and incorporated in 1991 with the principal objective to encourage higher standards of both burn injury prevention and patient care through research and education. Australia and New Zealand have regionalised burns care with 17 designated burns units across the two countries (Figure 1). The initial Bi-National Burns Registry was launched in 2004 with strong support from the ANZBA community. The registry was predominately an epidemiological data repository and was not able to meet the association's primary aim for the registry to improve quality of care. The revised Bi-National Burns Registry was launched in July 2009 and was renamed the Burns Registry of Australia and New Zealand (BRANZ). This clinical quality registry captures epidemiological, treatment, quality of care, and outcome data for adult and paediatric burn patients across Australian and New Zealand burn units. The project is a collaboration between the Australian and New Zealand Burn Association (ANZBA) and Monash University, Department of Epidemiology and Preventive Medicine (DEPM).

Figure 1: Designated burns units across Australia and New Zealand



The registry is an ANZBA initiative with additional funding from the Julian Burton Burns Trust (2008-2013), the Australian Commission on Safety and Quality in Health Care (2008-2009), the Helen Macpherson Smith Trust (2010-2012), the Thyne Reid Foundation (2011-2013), the New Zealand Accident Compensation Corporation (2013-2014), the Accident Corporation Commission (2014-2017) and the Australasian Foundation for Plastic Surgery (2013-2017). Individual burns units have also contributed to co-funding the registry to ensure the ongoing sustainability of BRANZ.

Participating Burns Units

Only sites with Institutional Ethics Committee (IEC) approval and the ability to provide resources for local data collection submit data to BRANZ. For the eighth year of reporting (July 2016 to June 2017), all 17 BRANZ sites with ethics approval contributed data to the eight annual report. Appendix 5 summarises the participating BRANZ sites.

Aims

The overall purpose of the registry is to monitor burn injury incidence, burn injury causation and to identify objective and verifiable data on treatment, outcomes and quality of care with the principal objective to encourage higher standards of both burn injury prevention and patient care.

The specific aims of BRANZ are to:

i. Describe the epidemiology of burn injuries and inform the development of burn injury prevention strategies in Australia and New Zealand;

ii. Monitor the type and quality of burn care management;

iii. Establish the clinical outcomes of burn patients;

iv. Improve service planning;

v. Develop best practice clinical guidelines and initiatives;

vi. Benchmark performance indicators on a state, national and international level.

Project Achievements

Reporting

Quarterly reports are routinely produced and provide summary aggregate data from the registry. The quarterly reports have been updated to enable comparison of individual burn units for key indicators. Data completeness by site is now also included in the quarterly reports. Individual sites are not identified by name in these reports but provided with their own identifier code to enable them to evaluate their own data relative to other sites. Additional reporting functions have been generated to allow individual units to produce their own reports and download data for their unit-specific purposes.

Data Requests

External requests for data must comply with BRANZ Data Access Policy. The data request form and associated policies are publicly available on the internet at https://www.branz.org. In the eighth year of reporting, there were five requests for data from BRANZ for purposes such as research, injury prevention, education and public awareness campaigns. Of these requests, three had data provided.

Presentations

During the reporting period, BRANZ was presented at the following national and international meetings:

1. International Society for Burn Injuries Congress, Miami, August-September 2016: Accreditation of Australian Burns Units: Present Activities and Challenges. Heather Cleland.

2. International Society for Burn Injuries Congress, Miami, August-September 2016: Water First Aid Is Beneficial In Humans Post-Burn: Evidence from a Bi-National Cohort Study. Dale Edgar.

3. Australian and New Zealand Burns Association Annual Scientific Meeting, Auckland, October 2016: Using BRANZ data to improve burn care quality. Yvonne Singer.

BRANZ was presented at many educational seminars during the 2016-2017 reporting period, including:

1. Australian and New Zealand Burns Association Nursing Forum, Fremantle, March 2017: Using BRANZ data to improve burn care quality. Yvonne Singer.

Publications

During the reporting period, the following studies were published using BRANZ data:

1. Gabbe BJ, Cleland H, Watterson D, Schrale R, McRae S, Taggart S, Darton A, Wood F, Edgar DW, et al. (2016) Predictors of moderate to severe fatigue 12 months following admission to hospital for burn: Results from the Burns Registry of Australia and New Zealand (BRANZ) Long Term Outcomes Project. Burns. 2016 Aug; 42(5):1652-1661.

2. Read DJ, Tan SC, Ward L, McDermott K. (2017) Burns first aid treatment in remote Northern Australia. Burns: ePub ahead of print.

How does BRANZ operate?

Inclusion / Exclusion Criteria

i. All first admissions to an Australian or New Zealand Burns Unit where a burn injury is the principal reason for admission and the following criteria are met:
    a. The first admission is within 28 days of the burn injury
    b. All transfers from another hospital irrespective of the time of injury to admission
    c. The patient is not admitted under the Burns Unit or admitted to another hospital unit but requires a Burns Unit consult

ii. Admission to hospital for greater than 24 hours ***or*** the patient is admitted for less than 24 hours but requires a burns management procedure in theatre; ***or*** the patient dies within 24 hours of presentation to BRANZ hospital

iii. All readmissions to the Burns Unit within 28 days of the date of discharge from the first admission

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

Data Capture

Data collection is the responsibility of participating Burn Units. BRANZ data collectors are listed in Appendix 4. Patient data are retrieved via 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.

Registry Data Quality Assurance

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.

Data Analysis

Number of Burn Cases

This section provides information about the number of patients admitted to a participating burns unit that met BRANZ inclusion criteria.

BRANZ burn cases

The total number of burn cases recorded by participating sites on BRANZ during the eighth year (1st July 2016 to 30th June 2017) was 3,295, with 2,301 adult cases (16 years of age and older) and 994 paediatric cases (15 years of age and under).

Registry admissions by quarter

Figure 2 shows the numbers of adult and paediatric cases entered into the registry at each quarter from commencement and Table 1 outlines the case numbers entered by each site for the eight reporting years. Although the registry began in July 2009, commencement of data contribution to BRANZ varied among the different sites and as seen in Table 1 some sites did not contribute in certain years. These inconsistencies in recording of registry data currently limit the capacity to carry out comparisons between sites and over time.

Figure 2: Reporting year trends in burn patients

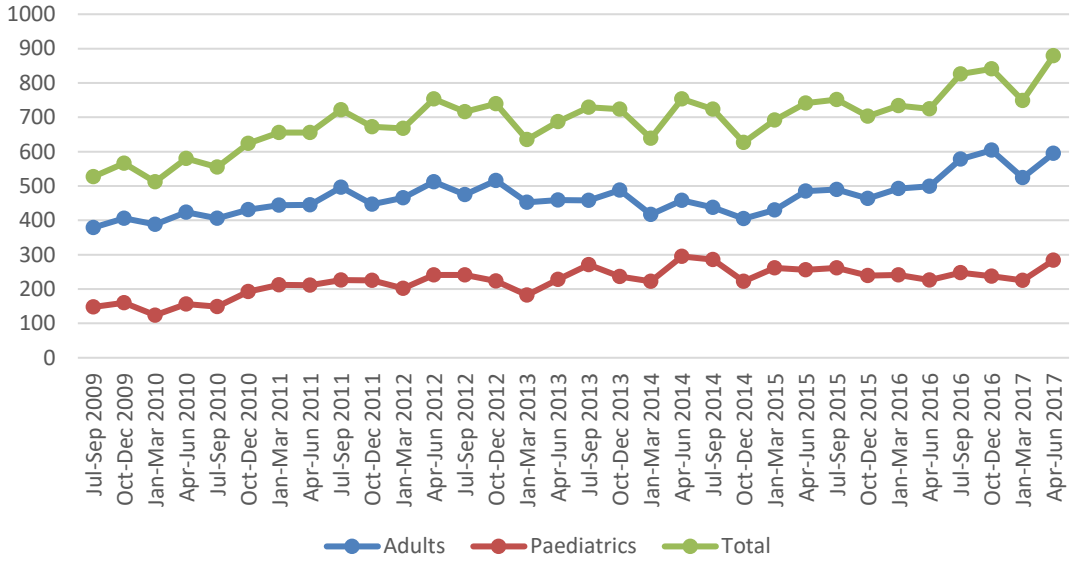


Table 1: Site case numbers per reporting year

Site	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	TOTAL
A	282	262	303	283	247	256	282	333	2,248
B	224	173	205	162	110	148	129	110	1,261
C	237	269	262	274	270	231	292	358	2,193
D	84	80	89	100	94	88	81	106	722
E	333	321	329	386	354	301	352	299	2,674
F	196	266	232	168	180	177	190	171	1,580
G	0	136	217	220	195	174	177	176	1,295
H	9	0	20	13	130	134	105	123	535
I	55	85	75	83	96	81	91	83	649
J	2	65	84	75	79	64	83	62	514
K	0	62	104	88	86	106	121	112	679
L	121	92	103	78	71	66	77	94	702
M	0	0	0	52	93	109	100	98	452
N	192	236	273	289	263	267	239	219	1,978
O	0	0	0	0	0	0	1	384	385
P	245	219	238	236	276	298	260	260	2,032
Q	205	225	281	270	301	284	334	306	2,206
Total	2,185	2,491	2,815	2,777	2,845	2,784	2,914	3,294	22,106

Demographic Profile of Hospitalised Burn Patients

Figures 3a and 3b show the age distribution by gender for paediatric and adult cases. Sixty-seven per cent of all cases were males and they represented the majority of cases in all age groups. Thirty-three per cent of paediatric cases were aged 1 to 2 years while 25 per cent of the adult cases were aged 20 to 29 years. These figures are consistent with the previous six BRANZ reporting years. The findings are also consistent with the American National Burn Repository (American NBR) 2016 annual report where males represented 68 per cent of cases, 30 per cent of paediatric cases were aged 1 to 2 years and 21 per cent of the adult cases were aged 20 to 29 years.

Figure 3a: Age distribution by gender – paediatric cases

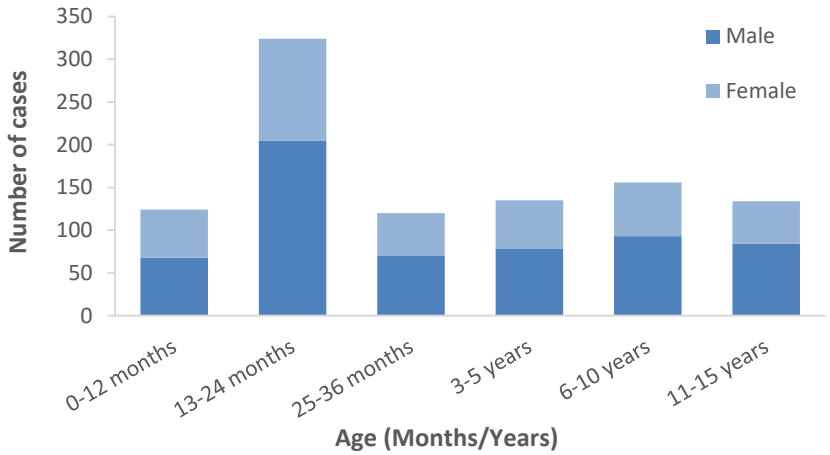
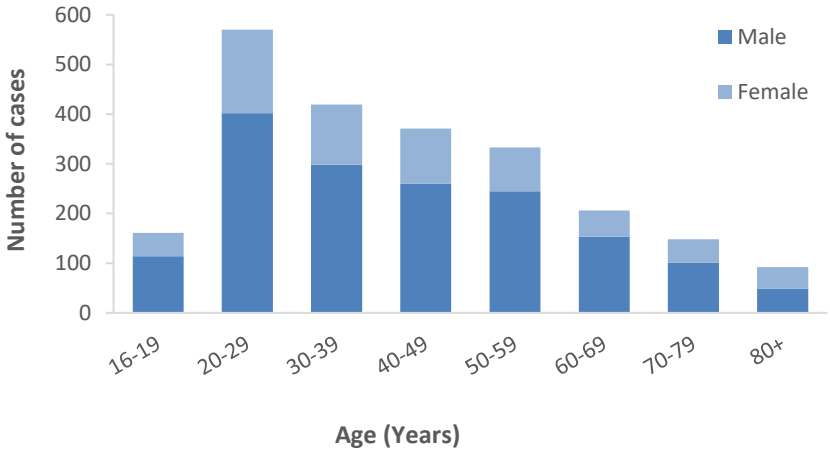


Figure 3b: Age distribution by gender – adult cases



Australian hospitals routinely collect 'country of birth' whereas New Zealand hospitals record the 'ethnicity' of their patients. Therefore the data are reported separately for New Zealand and Australian burn centres (Table 2). In 2016-2017 BRANZ recorded 2,821 admissions to Australian sites and 437 admissions to New Zealand sites.

The majority of cases admitted to Australian burns units were born in Australia (n=2,314, 82 per cent). Indigenous Australians accounted for 8 per cent of the Australian born admissions, consisting of 13 per cent of paediatric cases and 5 per cent of adult cases. This is consistent with proportions of both adult and paediatric indigenous cases in the previous reporting year. Of the patients admitted to Australian burns units, 507 were recorded as being born overseas. The country of birth was missing for 30 cases.

Of the New Zealand burn admissions, 50 per cent (n=188) were classified as 'New Zealander' and a further 35 per cent of cases (n=130) were classified as 'New Zealand Maori'. There were 52 patients classified as 'Other Oceanian descent'. These were predominantly Samoan (n=23, 44 per cent of other Oceanian and 6 per cent of total NZ admissions) but also included Cook Island Maori, Tongans and other Pacific Islanders.

Table 2: Region of birth for Australian and Ethnicity by region for New Zealand burns units

Region of birth - Australian Units	N	%
Australian Peoples	2314	82
North-West European	121	4
Southern and Eastern European	73	3
Southern and Central Asian	60	2
New Zealand Peoples	58	2
South-East Asian	50	2
North-East Asian	44	2
People of the Americas	27	<1
North African and Middle Eastern	26	<1
Oceanian (other)	25	<1
Sub-Saharan African	23	<1

Region of Ethnicity - New Zealand Units	N	%
Oceanian	376	86
Southern and Central Asian	22	5
North-West European	10	2
South-East Asian	10	2
North-East Asian	8	2
People of the Americas	*	<1
Sub-Saharan African	*	<1
North African and Middle Eastern	*	<1
Southern and Eastern European	*	<1

* Less than five cases

Most cases admitted to Australian burns units were funded by the Australian Health Care Agreement (n=2426, 85 per cent). A further 6 per cent (n=173) were covered under the relevant workers compensation scheme in each state or territory and 6 per cent (n=180) were funded through various private health insurance schemes. Examples of other sources of funding were third party motor vehicle insurance, department of Veterans Affairs, Department of Defence and reciprocal health care agreements.

All New Zealand cases were funded by the Accident Compensation Corporation (n=437, 100 per cent) which is the comprehensive, no-fault personal injury insurance scheme for all New Zealand residents and visitors to the country.

What Was the Cause and Location of the Events Leading to a Burn Injury?

This section outlines the cause of burn injury, the activities leading to injury, the places of injury, and the geographical region of the injury across Australia and New Zealand.

Burn Injury Cause

Consistent with previous years, scald and flame burns were the most common cause of burn injury. Scalds accounted for 36 per cent, flame burns for 33 per cent, and contact burns for 17 per cent of all cases. The 2016 data from the American NBR also identified flame burns and scalds as the most common aetiology, however flame related injuries were more frequent (41 per cent) than scald injuries (33 per cent) in the USA.

Tables 3a and 3b outline the cause of injury by paediatric and adult age groups and Figure 4a and 4b compares common burn causes across these groups. The most common overall cause for burn injury among paediatric cases was scalds (57 per cent) followed by contact (23 per cent) and flame (10 per cent) injuries. Scald burns were the most common cause of injury across all paediatric age groups. This contrasts with last year, when flame burns were slightly more common in the 11-15-year group, but is consistent with earlier previous years.

The most common overall cause of adult burn injuries was flame (43 per cent) followed by scald burns (27 per cent) and contact burns (15 per cent). In the adult age range of 16 to 79 years, flame burn was the most common cause of injury and scald burns were the predominant cause of burn injuries for patients aged over 80 years.

Table 3a: Primary cause of burn by paediatric age group

Primary Cause of Burn	Paediatric Age Group (months and years)							
	0-12 months	13-24 months	25-36 months	3-5 years	6-10 years	11-15 years	Total	%
Scald	85	240	72	58	69	44	**568**	**57**
Contact	25	64	28	37	44	31	**229**	**23**
Flame	5	*	5	18	28	38	**98**	**10**
Friction	*	8	11	15	12	9	**56**	**6**
Chemical	*	5	*	*	*	*	**12**	**1**
Radiant Heat (no contact to source)	5	*	*	*	*	*	**13**	**1**
Cooling	*	*	*	*	*	*	*	**<1**
Electrical	*	*	*	*	*	*	**11**	**1**
Pressurised gas/air (non-flame)	*	*	*	*	*	*	*	**<1**
Other	*	*	*	*	*	*	*	**<1**
Total	**123**	**324**	**121**	**134**	**155**	**134**	**991**	**100**

* Less than five cases

Table 3b: Primary cause of burn by adult age group

Primary Cause of Burn	Adult Age Group (years)									
	16-19	20-29	30-39	40-49	50-59	60-69	70-79	80+	Total	%
Flame	74	264	186	151	137	93	56	22	**983**	**43**
Scald	38	124	106	103	92	57	49	48	**617**	**27**
Contact	32	90	59	46	48	30	23	14	**342**	**15**
Chemical	5	35	27	42	31	9	7	*	**157**	**7**
Friction	9	33	17	9	5	*	*	*	**78**	**3**
Radiant Heat (no contact to source)	*	*	11	11	10	7	6	5	**53**	**2**
Electrical	*	13	9	*	7	6	*	*	**45**	**2**
Pressurised gas/air (non-flame)	*	*	*	*	*	*	*	*	**10**	**<1**
Cooling	*	*	*	*	*	*	*	*	**4**	**<1**
Other specified cause	*	*	*	*	*	*	*	*	**2**	**<1**
Total	**161**	**566**	**419**	**369**	**332**	**205**	**147**	**92**	**2,291**	**100**

* Less than five cases

Figure 4a: Frequency of flame, scald and contact burns by paediatric age group

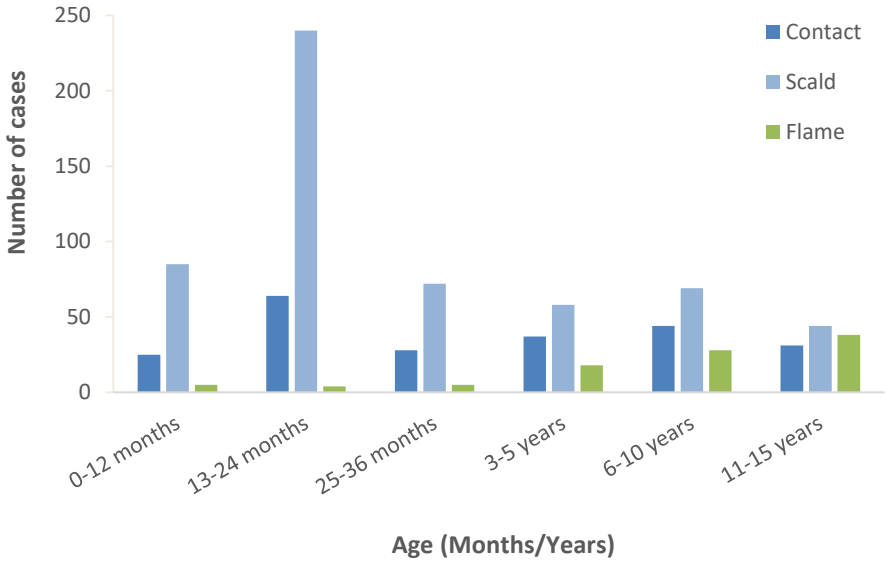
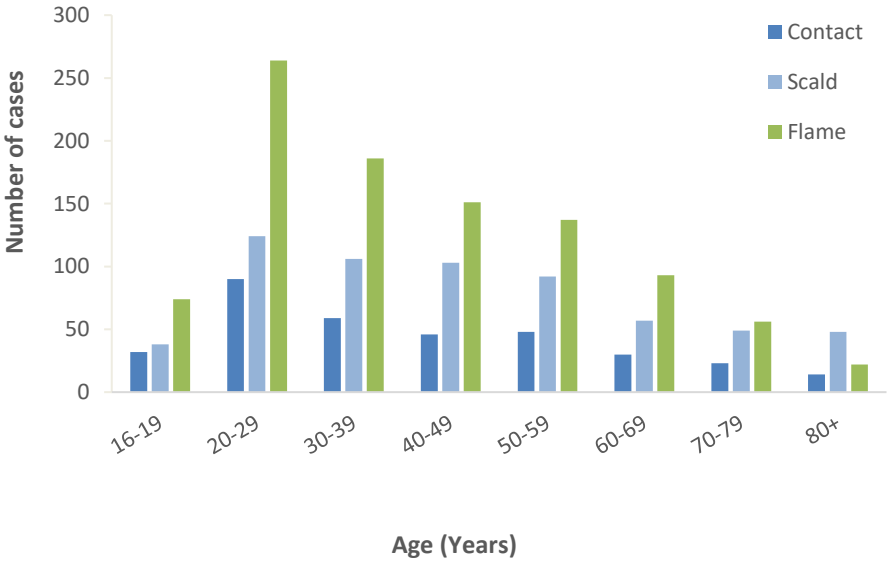


Figure 4b: Frequency of flame, scald and contact burns by adult age group



The most common sub-causes of paediatric and adult burn injuries are shown in Tables 4a and 4b. These sub-causes accounted for 78 per cent of paediatric cases and 58 per cent of all adult cases.

In paediatric cases, hot beverages were the most common cause of scald injury followed by water from a saucepan, kettle, jug, billy, urn or thermos and scald injury from food. In adult cases, flame burns resulting from a campfire, bonfire or burn-off were the most common sub-cause, followed by scald burns due to fat or oil and flame burns from other causes. The three most common sub-causes of burn injury in both adults and paediatrics have been consistent over the past five years, however flame burns from other causes replaced scalds due to fat or oil as the second third prevalent sub-cause in adult cases this year.

In 61 per cent of flame burn cases, an accelerant was used to ignite or enhance the flame. Petrol was the most common accelerant used (56 per cent) followed by methylated spirits (11 per cent). Petrol has been the predominant accelerant, and methylated spirits the second most common accelerant, for all years of reporting by BRANZ.

Table 4a: Primary sub-causes of burn injury in paediatric cases

Cause	Sub Cause	N	%
Scald	Hot Beverages	190	20
Scald	Water from saucepan/kettle/jug/billy/urn	130	13
Scald	Food (liquid/solid)	81	8
Contact	Coals/Ashes	63	6
Scald	Water from tap/bath/shower	43	4
Scald	Fat/Oil	42	4
Contact	Vehicle Exhaust	42	4
Friction	Treadmill	36	4
Flame	Campfire/Bonfire/Burn-off	34	4
Scald	Other source	26	3
Contact	Iron	21	2
Contact	Hot Metal	18	2
Contact	Wood heater	18	2
Flame	Lighter/matches	17	2
Scald	Water from hot-water bottle	15	2

Table 4b: Primary sub-causes of burn injury in adult cases

Cause	Sub-Cause	N	%
Flame	Campfire/Bonfire/Burn-off	306	14
Scald	Fat/Oil	150	7
Flame	Other	127	6
Scald	Water from saucepan/kettle/jug/billy/urn	125	6
Chemical	Alkali	113	5
Flame	Other source	91	4
Flame	Vehicle/Engine parts	87	4
Flame	Gas/Gas Bottle	75	3
Contact	Coals/Ashes	65	3
Contact	Contact Hot/Metal	63	3
Flame	Welder/Grinder	63	3
Scald	Food liquid/solid	60	3
Scald	Hot Beverages	60	3
Friction	Via vehicle/motorbike	60	3
Contact	Vehicle Exhaust	42	2

Seasonal Trends

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. While the primary burn cause was recorded for all patients, a burn injury sub-cause was recorded for 97 per cent of adult (n=2,239) and 98 per cent paediatric (n=972) cases. The primary burn cause and sub-cause were categorised according to the season and this data is presented in Figures 5a and 5b. Consistent with previous reporting years, patterns of seasonal variations were mainly observed in relation to burn injuries caused by heaters, hot water bottles and barbeques.

Paediatric cases

The definition of heaters includes electric, wood, gas, open fireplace and any other heater types. Burn injuries caused by heaters showed a seasonal trend in paediatric injuries with most cases occurring during winter (n=20, 57 per cent). There were only two injuries caused by a heater recorded in the summer months. Heater burns were predominantly contact or flame injuries and there were no injuries in paediatric cases caused by radiant heat. Scald injuries caused by hot beverages occurred consistently over the seasons. In contrast, scald injuries caused by water from a saucepan, kettle, jug, billy, urn or thermos occurred more frequently in autumn (29 per cent). These proportions are inconsistent with the previous year.

Burns caused by contact with a vehicle exhaust were more prevalent in summer and autumn (60 per cent) compared to the spring and winter months.

The highest incidence of contact burns caused by coal and ashes (37 per cent) occurred in autumn. The incidence of flame burn injuries caused by campfires, bonfires and burn-offs was lowest during the summer months (6 per cent) and highest during winter (41 per cent).

Adult cases

In adult cases, approximately half of burns caused by heaters (51 per cent) and hot water bottles (47 per cent) occurred in winter (Figure 5b), reflecting the higher levels of exposure to these items in the cooler months. While winter still had more adult burns caused by coals and ashes than any other season, in contrast to previous years this proportion was less than half (40 per cent). Most barbeque related burns caused flame injuries (n=35, 88 per cent) and most cases occurred during winter, summer and autumn.

Use of an accelerant was recorded for 74 per cent (n=26) of the flame burns resulting from barbeques.

Flame burns from welders and friction burns from vehicles and motorbikes showed a seasonal pattern different to the last reporting period, where there was a higher incidence in the winter and spring. A higher incidence of flame welder burns occurred in spring (47 per cent) and autumn (25 per cent) compared to winter (12 per cent) and summer (14 per cent). A higher incidence of friction burns from vehicles and motorbikes was seen in autumn (29 per cent) and spring (29 per cent).

Consistent with paediatric cases, the number of adult burn injuries caused by campfires, bonfires and burn-offs was lowest in the summer months (n=48, 16 per cent), compared to 28 per cent (n=85) occurring in autumn, 32 per cent (n=97) in winter, and 25 per cent (n=76) during spring (Figure 5b).

Figure 5a: Seasonal trends by burn cause (paediatric)

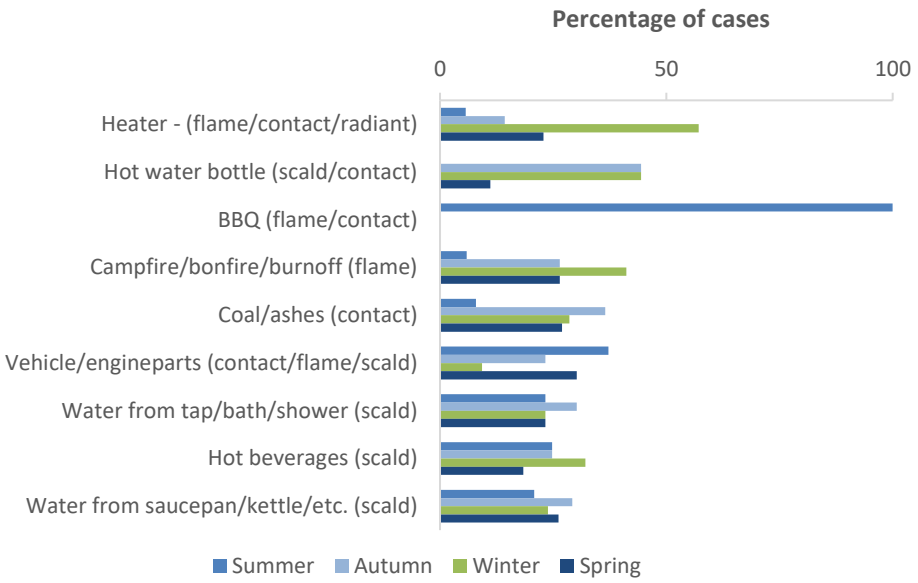
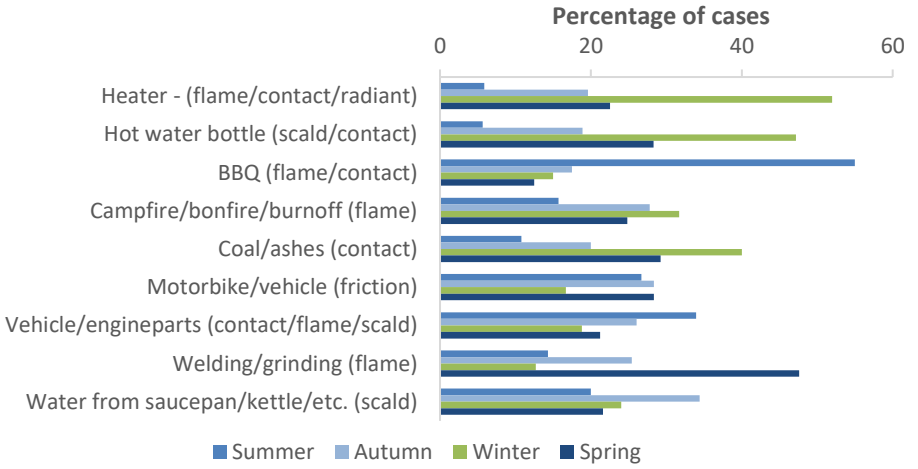


Figure 5b: Seasonal trends by burn cause (adult)



** "Heater" is inclusive of electric, wood, gas and any other heater types coded as 'heater'*

Intent, place, and activity of injury

The majority of burns patients (93 per cent) sustained their injury during unintentional events. Intentional self-harm accounted for four per cent of all cases. The remaining cases included assaults, adverse effects or complications of medical treatment, or the intent was not known. Compared to unintentional burn cases, a higher proportion of intentional self-harm cases sustained injuries that were greater than 10 per cent TBSA (24 versus 5 per cent).

The place of injury for paediatric and adult cases are summarised in Tables 5a and 5b. Most burn injuries occurred at home (64 per cent). This finding is consistent with previous reporting years and the American NBR. In 79 per cent of paediatric cases and 57 per cent of adult cases, the injury occurred at home.

Table 5a: Place of injury – paediatrics

Place of injury	N	%
Home	765	79
Other residence (e.g. friend's House)	76	8
Place for recreation	54	6
Street and highway	23	3
Farm	14	1
School, other institution and public administrative area	12	1
Trade and service area	*	<1
Sports or athletics area	5	<1
Other specified place	18	2
Total	970	100.0

* Less than five cases

Table 5b: Place of injury – adults

Place of injury	N	%
Home	1253	57
Trade and service area	182	8
Place for recreation	162	7
Street and highway	151	7
Other residence (e.g. friend's House)	136	6
Industrial and construction area	120	5
Farm	81	4
School, other institution and public administrative area	20	1
Residential Institution	10	<1
Sports or athletics area	7	<1
Other specified place	67	3
Total	2,189	100.0

The kitchen was the place of injury for 50 per cent of paediatric cases and 31 per cent of adult cases that sustained the burn injury at home. The next most common places of burn injury occurrence for paediatric cases were the living room, playroom or family room (18 per cent) and the garden or yard (12 per cent). In adults, the garden or yard (25 per cent) was the next most common place of injury, followed by the living room (10 per cent).

Tables 6a and 6b outline common activities being performed at the time of injury for paediatric and adult cases. Being near a person preparing food or drink, playing and participating in leisure activity were the most common activities at the time of injur for paediatric cases. Of the children two years of age and younger who sustained a scald injury (n=230) 62 per cent of these injuries occurred whilst near a person preparing food or drink. This is consistent with previous reporting years.

The most common activities resulting in a burn injury in adults were participating in a leisure activity, cooking, and working for income. Of the adults cases whose activity at the time of injury was recorded as working for income, and there was a recorded place of injury, 42 per cent (n=134) occurred at a 'trade or service area', followed by an 'industrial or construction area' (n=114, 35 per cent). These figures are similar to the previous reporting year.

In the 20 to 29 years age group, leisure activities accounted for 28 per cent of burns and the place of injury was in the home 227 (43 per cent) cases, followed by place for recreation (13 per cent). This is different from the previous reporting period, in which 'trade or service area' was the second most frequent place of injury in this age group. In the 60 years and over age group, the most common activity at the time of injury was cooking (23 per cent). This is consistent with the previous BRANZ annual reports.

Table 6a: Activity at the time of injury - Paediatrics

Activity at the time of injury	N	%
Near person cooking	296	31
Playing	279	30
Leisure activity (excluding sporting activity)	114	12
Cooking	57	6
Bathing	38	4
Sleeping/resting	32	3
Eating/drinking	25	3
Driving	18	2
Other vital activities	16	2
Sport activity	6	<1
Education	5	<1
Cleaning	*	<1
Gardening	*	<1
Other types of unpaid work	*	<1
Self-harming	*	<1
Working for income	*	<1
Household maintenance	*	<1
Suspected illegal activity	*	<1
Other specified activities	36	4
Total	943	100

* Less than five cases

Table 6b: Activity at the time of injury - Adults

Activity at the time of injury	N	%
Leisure activity (excluding sporting activity)	442	20
Cooking	437	20
Working for income	329	15
Sleeping/resting	156	7
Household maintenance	130	6
Driving	116	5
Self- harming	101	4
Vehicle maintenance	98	4
Other vital activities	53	2
Bathing	47	2
Cleaning	43	2
Gardening	43	2
Eating/drinking	34	2
Other types of unpaid work	28	1
Suspected illegal activity	21	<1
Sports activity	11	<1
Near person cooking	10	<1
Playing	7	<1
Education	*	<1
Other specified activities	118	5
Total	2,226	100

* Less than five cases

Drug and alcohol involvement

For the majority of cases (84 per cent), there was no documented suspicion of drug or alcohol involvement and this is consistent with previous BRANZ annual reports. A documented suspicion of alcohol only, without drug involvement was recorded in 12 per cent of cases, drugs without alcohol in one per cent of cases and a combination of drugs and alcohol was recorded in two per cent of cases. 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.

Location of burn injury by region (Australian Sites)

Consistent with previous years, over half (58 per cent) of burns admissions to Australian units occurred in major cities according to the Australian Bureau of Statistics Classification of Remoteness (2). A further 36 per cent occurred in regional Australia, and six per cent in remote areas.

The rate of burn injury resulting in burns unit admission per 100,000 population is over twice as high for very remote areas compared to major cities. This is consistent with the rate from the previous reporting period. All burn units are located in major cities, highlighting the implications for transport and pre-hospital care, as well as for provision of rehabilitation.

Table 7 shows the total rate of burn injury resulting in burns unit admission per 100,000 population, and the rate for non-indigenous and indigenous Australians. The rate of admission to Australian burns units for the Aboriginal and Torres Strait Islander population is more than triple that of the non-indigenous population. The severity of burn injuries was not significantly different between the indigenous and non-indigenous populations as measured by the pattern of burn size but median length of hospital stay was longer for indigenous patients (six versus three days).

Table 7: Total rate of injury per 100,000 population and the rate of burn injury in non-indigenous and indigenous Australians

Remoteness Category	Rate per 100,000 population		
	Total	Non-indigenous	Indigenous
Major cities of Australia	9	7	19
Inner regional Australia	11	10	18
Outer regional Australia	14	10	43
Remote Australia	25	16	67
Very remote Australia	20	13	24
Total rate of injury	10	9	33

Burn Injury Severity

This section outlines the severity of burn, by burn size (percentage total body surface area burnt, percentage TBSA), burn depth and the presence of an inhalation injury.

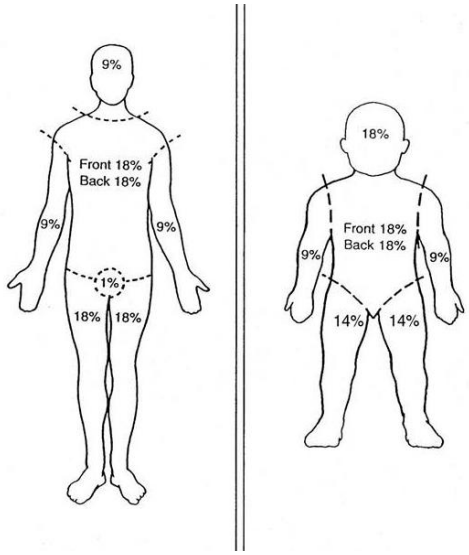
Total Burn Surface Area (per cent TBSA)

A burn of less than 10 per cent TBSA was recorded for 84 per cent of adult and paediatric cases, and this finding is consistent with previous BRANZ annual reports. For paediatric patients, 88 per cent sustained a burn of less than 10 per cent TBSA, and just over three per cent sustained a burn that was greater than 20 per cent TBSA. For adult patients, 82 per cent of cases experienced a burn less than 10 per cent TBSA and seven per cent sustained a burn that was greater than 20 per cent TBSA. Less than two per cent of adult cases involved a burn of 50 per cent or greater TBSA. Table 8 shows the distribution of TBSA for paediatrics and adult cases.

Table 8: Percentage Total Body Surface Area Burnt – Paediatrics and Adults

% TBSA category	Paediatrics		Adults	
	N	%	N	%
0-9%	878	88	1,889	82
10-19%	80	8	242	11
20-49%	32	3	123	5
≥ 50%	*	< 1	47	2
TOTAL	994	100	2,301	100

* Less than five cases



Rule of Nines – example of a burn assessment tool

The size of the burn alone is not the only measure for admission to a burns unit in Australia and New Zealand and ANZBA criteria for specialised burns treatment include: smaller burns to special areas (face, hands, feet, perineum and major joints), elderly patients, pregnant patients and those with other comorbidities (Appendix 8). Of the adult patients with a burn less than 10 per cent TBSA (n=1,887, 82 per cent), 16 per cent involved the face, 30 per cent were hand burns and 17 per cent involved burns to the feet.

Seventy-six per cent of burn injuries reported to the American NBR in 2016 were less than 10 per cent TBSA. Previous studies in the USA have shown that a high proportion of burn patients meeting criteria for admission to burns units were managed at hospitals other than specialist burn centres. Therefore, the difference noted in the distribution of burn size between the American NBR and BRANZ could be due to greater compliance with guidelines for admission to a burn unit in Australia and New Zealand (Appendix 8). Alternatively, another possibility is that patients with less serious injuries that may not require specialised burn care, are in some instances still being admitted to burns centres in Australia and New Zealand.

Burn Depth

As described in previous annual reports, improvements in the BRANZ database from July 2010 allowed for greater accuracy of reporting burn depth. BRANZ reports on burn depth by documenting the presence of injuries involving superficial-dermal, mid-dermal, deep-dermal and full thickness burns. Burn injuries can include multiple areas of multiple depths. The burn depth was recorded for 94 per cent of cases in the 2016-2017 reporting period. Of these, 46 per cent (n=1,288) had reported superficial dermal burns, 52 per cent (n=1,375) had reported mid dermal burns, and 45 per cent (n=1,188) had deep dermal burns.

A full thickness burn was documented for 30 per cent of cases (n=843), which is a slight increase from the previous reporting period. Of the cases documented as having a full thickness burn, the per cent TBSA value of the full thickness area was known in 92 per cent (n=774) of the cases. Table 9 outlines the number of cases where the percentage TBSA of full thickness burn size was recorded. The proportion of cases with coded full thickness burns greater than 10 per cent of the TBSA was 14 per cent, which is consistent with the previous reporting period.

Table 9: Per cent value of full thickness area in patients with full thickness burns

% full thickness TBSA	**N**	**%**
< 10 % full thickness	644	86
10-19 % full thickness	38	5
20-49 % full thickness	30	4
≥50 % full thickness	34	5
Total	746	100

Inhalation injury

Inhalation injuries are complex and are suspected on the basis of a history of mechanism of injury, smoke exposure, clinical presentation and diagnostic investigations. Burns to the oropharynx and upper airway can result in swelling and possible airway obstruction within the first few hours after injury. An inhalation injury is recorded if it is documented in the patient's medical record. There is currently no consensus globally or across BRANZ sites for defining and the reporting of inhalation injuries given the challenges in recognising and diagnosing an inhalation injury. A documented inhalation injury was recorded for five per cent of adult cases (n=121) and less than one per cent of paediatric cases. A higher proportion of inhalation injuries in adults is consistent with flame being the most common cause of burn injury in adults. Of the patients who died following their burn injury, 52 per cent had sustained an inhalation injury.

How were the burns patients managed prior to admission to the burns unit?

This section describes the pre-hospital phase and burn cooling (first aid) response, the referral process and transfer times. Quality indicator data that is associated with the standard of care documented is also given. Data from this and future reports will guide the establishment of suitable standards of care across Australia and New Zealand.

Burn Cooling

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 is best practice in order to reduce the area of skin affected by the burn, the depth of the burn and for pain management (3–6). Prolonged extensive irrigation of burns may be detrimental if the patient becomes excessively cold, and, the symptoms of hypothermia need to be monitored, particularly in children with larger burns (3,4,7,8).

Seventy-five per cent (n=2,478) of all cases were reported to have received some form of first aid following the burn injury. A higher proportion of paediatric cases (87 per cent) received some form of first aid than adult cases (70 per cent), which is consistent with previous reporting years.

Twenty minutes of cool running water within three hours was the form of applied first aid in 83 per cent paediatric cases and in 74 per cent of adult cases that received first aid following the burn injury (Table 10). Fourteen per cent of paediatric cases and 21 per cent of adult cases that received first aid other than 20 minutes of cool running water within three hours of the burn injury.

Table 10: Documented First Aid Following Burn Injury

	Paediatrics		Adults	
	N	%	N	%
First Aid Applied	861	86	1,617	70
Was the first aid 20 minutes of cool running water within three hours of injury?	711	83	1,194	74

What was the referral source to the burns unit?

Consistent with previous annual reports, approximately half of both the paediatric (50 per cent) and adult cases (57 per cent) were transferred to a burns unit from another hospital. The proportion of cases that were directly transported to the burns unit from the scene of injury via ambulance was 16 per cent for paediatric patients and 28 per cent for adult cases. These figures are consistent with previous reporting years.

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 registry therefore collects data on the length of time taken to admission from time of injury, and reasons as to why the admission to a burns unit is greater than two hours. 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 was 19 (3-165) hours for paediatric cases and 18 (4-108) hours for adult cases.

The initial treatment of a burn patient is critical for reducing the risk of complications, poor long-term outcomes and mortality. 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 per cent TBSA in adult cases and greater than 10 per cent TBSA in paediatric cases can be considered as a major burn.

Figure 6a and 6b show the median time from injury to admission for paediatric and adult cases for each reporting year. Only those cases that require emergency admission to hospital for major burns (paediatric patients with over 10 per cent TBSA and adult patients with over 20 per cent TBSA) are included. The median values for time to admission for both paediatric and adult cases have remained consistent.

Figure 6a: Time to Admission for paediatric cases (>10 per cent TBSA) for Years 1-8

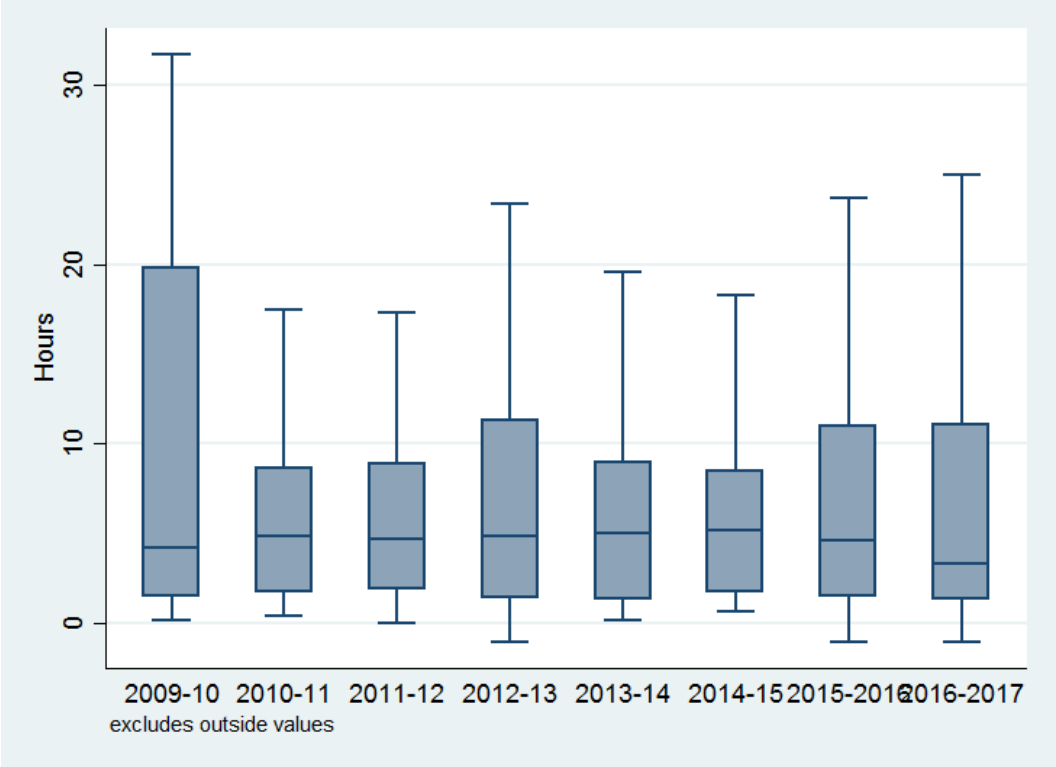
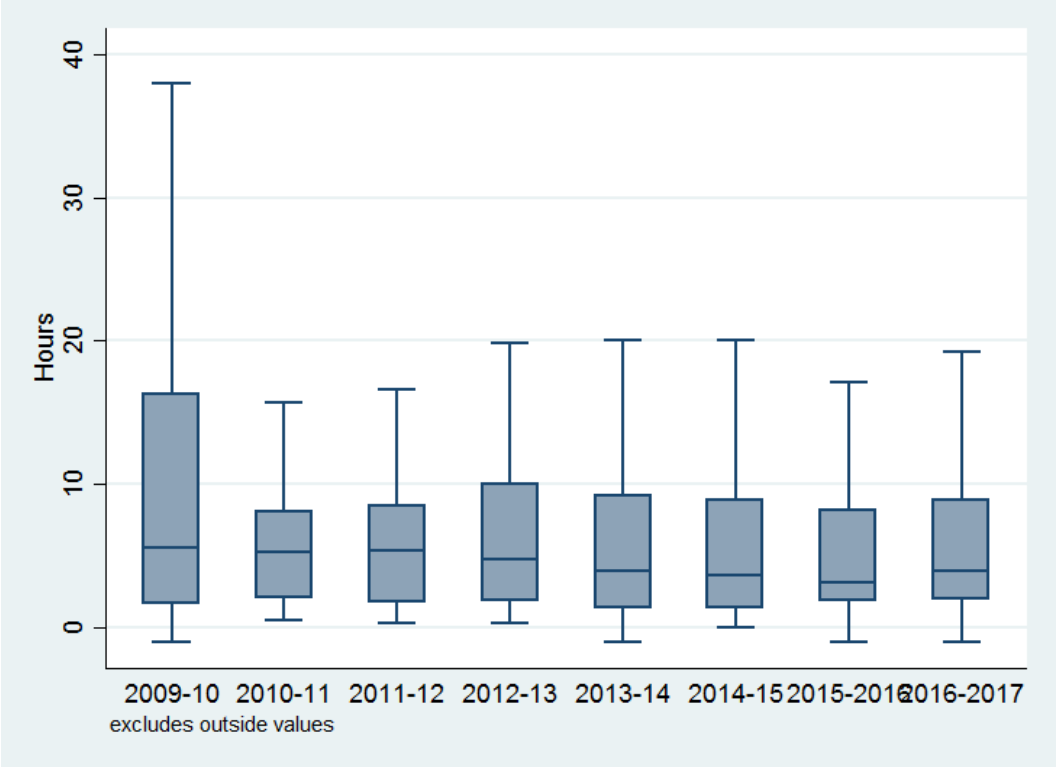


Figure 6b: Time to Admission for adult cases (>20 per cent TBSA) for years 1-8



For adult cases transferred from the scene of injury to the specialist burn unit with a burn size greater than 20 per cent TBSA, 49 percent of cases arrived at a BRANZ hospital within two hours of injury, and 95 percent arrived within 7 hours. In paediatric cases transferred from the scene of injury to the specialist burn unit with a burn size greater than 10 per cent TBSA, 74 per cent of patients arrived at a BRANZ hospital within two hours of injury, and 88 per cent of patients arrived within three hours of injury.

Burn unit performance

The following section outlines burns unit performance and reports quality of care data for established processes of care. Data from this and future reports will be instrumental in developing standards of acceptable performance for burns care across the region.

Wound assessment

The definitive burn wound assessment is defined as the burn assessment documented by a senior burns clinician within 72 hours of admission.

In 99 per cent of paediatric cases, and 96 per cent of adult cases, their definitive burn wound assessment was documented within 72 hours of admission to hospital. This is higher than the previous reporting year (93 per cent for paediatrics and 89 per cent for adults) and much higher than the period before that (61 per cent for paediatrics and 66 per cent for adults). For paediatric cases, the burn registrar recorded the burn wound assessment within 72 hours of admission for 50 per cent of cases, followed by the burns consultant (11 per cent), burn care nurse coordinator or nurse practitioner (six per cent), and burns fellow (four per cent).

For adult cases, where assessment was documented within 72 hours, the person conducting the assessment was the burns registrar in 39 per cent of cases, followed by the burns consultant (30 per cent), burn care nurse coordinator or nurse practitioner (10 per cent), and burns fellow (five per cent).

In other instances, for both paediatrics and adults, the burn wound assessment was carried out by the burns resident, a senior burns nurse or by an emergency department clinician.

Theatre for burn wound excision

Seventy-seven per cent of all cases underwent at least one burn wound management procedure in an operating theatre and this is consistent with previous reporting years. Table 11 outlines the percentage of paediatric and adult cases that had a particular procedure. One case may have multiple procedures recorded but data is collected only for the first time to theatre for a particular procedure. The 'other' procedures were predominately primary wound closure, free flap, scrub and dress and the application of dressing such as negative pressure wound dressings.

Burn wound debridement and skin grafting was completed for 61 per cent of paediatric and adult cases. For cases where a full thickness burn was recorded, only 79 per cent of paediatric cases and 83 per cent of adult cases underwent debridement and grafting. These figures are comparable with the previous reporting years. The proportion of paediatric and adult patients with full thickness burns that underwent debridement and skin grafting was 78 and 83 per cent in 2014-2015, and 70 and 79 per cent in 2013-2014, respectively. However, since debridement and grafting is the recommended acceptable management for all but very small full thickness burns, this data requires further examination. Of the patients that had a full thickness burn where the size of the burn was documented (n=460) in the seventh reporting year, the full thickness per cent TBSA was less than one per cent in 35 per cent of cases.

The median (IQR) time to grafting from injury was 11 (7-15) days for paediatric cases, which is consistent with the previous year. For adult cases, the median time to grafting from injury was 6 (4-11) days, which is consistent with the previous reporting period.

Table 11: Percentage of burn wound management procedures

	Paediatric cases		Adult cases	
Procedure	**N**	**%**	**N**	**%**
Procedures related to debridement				
Debridement and skin grafting	341	43	1221	68
Debridement and temporary skin closure product e.g. Biobrane™	120	15	342	19
Debridement only	214	27	344	19
Debridement and skin cell product (e.g. CEA)	100	13	235	13
Debridement and dermal reconstructive product e.g. Integra™	3	<1	7	<1
Total debridement procedures	778	-	2151	-
Other procedures not outlined above				
Dressing change in theatre only	126	85	34	22
Escharotomy/Fasciotomy/Amputation or combination	2	1	21	13
Other	20	14	101	65
Total Other procedures	148	-	156	-
Total Theatre Procedures	**926**	-	**2307**	-

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 (9–11). Allied health burn clinicians are responsible for assessing burns patients and commencing rehabilitation as early as possible.

Ideally, burns rehabilitation commences during the acute treatment phase. Of the paediatric patients who had a stay in hospital for more than 48 hours (n=453), 57 per cent had documentation of a physical functioning assessment by a physiotherapist or occupational therapist within 48 hours of admission. This is a decrease on the previous reporting year (80 percent). However, it is important to note that this indicator is no longer dependent on % TBSA, but only LOS. For adult patients with a stay in hospital of more than 48 hours (n=1,497), 87 per cent had documentation of a physical functioning assessment within 48 hours of admission, which is an increase on the previous reporting year (83 per cent).

Enteral / 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 (10,12–14), and in reducing the risk of gastrointestinal dysfunction. Of the paediatric cases with a burn greater than 15 per cent TBSA (n=38), supplementary feeding (either enteral or parenteral) was documented as commencing within 24 hours of admission for 84 per cent of patients. For adult cases with a burn greater than 20 per cent TBSA (n=129), supplementary feeding was documented as commencing within 24 hours for 69 per cent of patients. Due to changes in this quality indicator, it is not possible to compare this reporting year to the previous reporting year.

In-hospital Outcome of Burn Injury

This section describes the hospital outcomes of burn care, including intensive care (ICU), complications during the episode of care, length of stay, discharge disposition and re-admissions.

ICU admissions

Critical care management and mechanical ventilation may be required after burn injury (15,16). An ICU admission was reported for four per cent of paediatric cases and 10 per cent of adult cases, which is consistent with previous reporting years. Of the paediatric cases with a burn greater than 10 per cent TBSA, an ICU admission occurred for 33 percent of cases. This is slightly lower than the previous reporting period (42 per cent). For adult cases with a burn size greater than 20 per cent TBSA, an ICU admission occurred for 71 per cent of cases, which is slightly higher than the previous reporting period (65 per cent). The median (IQR) length of stay in ICU was 84 (24-274) hours for paediatric cases compared to 119 (43-365) hours in 2015-2016. For adult cases, the median (IQR) length of stay in ICU was 60 (29-232) hours compared to 79 (36-192) hours in 2015-2016.

The majority of patients (79 per cent) with a documented inhalation injury were admitted to ICU. The median ICU length of stay for paediatric (746 hours, IQR 576-917) and adult cases (72 hours, IQR 24-302) where an inhalation injury was documented.

The median (IQR) hours of ventilation for cases admitted to ICU was 69 (22-269) for paediatric cases and 52 (19-204) for adult cases. These numbers are lower than the previous reporting period for paediatric cases (158 hours), and higher than the previous reporting period for adult cases (48 hours).

Renal impairment (eGFR)

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 (17–20). Calculating RIFLE criteria (21) from serum creatinine and estimated glomerular filtration rate (eGFR) is a quantifiable and valid measure of renal function. A negative change in excess of 25 per cent of eGFR relative to a baseline measurement is considered indicative of a risk of kidney injury as per the RIFLE criteria. No paediatric cases were deemed to be at risk of kidney injury as defined by the RIFLE criteria. Thirty-four adult cases (one per cent) were deemed to be at risk of kidney injury as defined by the RIFLE criteria.

Blood cultures

Bloodstream infection is associated with increased risk of mortality in burn injured patients (22,23). A blood culture was collected during the inpatient stay in 28 per cent of adult cases (n=633) and 12 percent of paediatric cases (n=120). This rate of blood culture collection is consistent with the previous reporting period for adult cases (28 per cent), but is lower than the previous reporting period for paediatric cases (36 per cent). The proportion of burn patients who underwent blood culture collection was higher for cases with major burns. A blood culture was taken in 13 per cent of adult cases with a burn greater than 20 per cent TBSA, and 48 per cent of paediatric cases with a burn greater than 10 per cent TBSA.

For paediatric cases, less than one per cent of all cases had at least one positive blood culture (n=1). This figure is lower than the previous reporting period (two per cent). A positive blood culture was reported in four per cent of all adult cases who had blood cultures taken (n=27), which is a slight decrease compared to the previous reporting year (seven per cent).

Weight recorded and weight loss

Measuring the patient's weight is important for the initial fluid resuscitation of the burn patient and for monitoring 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 (10,13,24).

Of the paediatric patients, with a length of stay greater than two weeks (n=70), 90 per cent had their weight measured and documented within three to five days of admission. Fifty-six per cent had a weekly weight documented during their hospital stay. Sixteen paediatric patients lost weight.

For adult cases, with a length of stay greater than two weeks (n=30), 59 per cent had their weight measured and documented within three to five days of admission. A weekly weight was documented for 52 per cent of these patients. Weight loss was recorded in 71 adult patients.

The documented weight loss during the episode of admitted patient care ranged from 0.1 to 7 kg for paediatric cases, and from 0.1 to 25 kg for adult cases. The documented median (IQR) weight loss was 0.9 (0.5-2.8) kg for paediatric cases, and 4 (2.3-7) kg for adult cases. 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.

Length of stay

The length of admission is associated with increased case complexity, and is impacted by treatment protocols (25). Cases that did not survive to discharge, or where the length of stay was less than 24 hours, were excluded from the analysis of length of stay.

The median (IQR) length of stay for paediatric patients was 3 (2-8) days, consistent with previous reporting periods. Figure 7a shows the distribution of length of stay by percentage TBSA grouping for paediatric patients.

The median (IQR) length of stay for adult cases was 6 (3-12) days, a slight increase compared to previous reporting periods. Figure 7b shows the distribution of hospital length of stay by percentage TBSA for adults.

Larger burns were associated with a greater hospital length of stay for both paediatric and adult cases. The average length of stay across BRANZ population was eight days. This figure is comparable to the average length of stay of eight days reported in the American NBR.

Figure 7a: Distribution of the length of stay by percentage TBSA – Paediatric cases (excluding deaths)

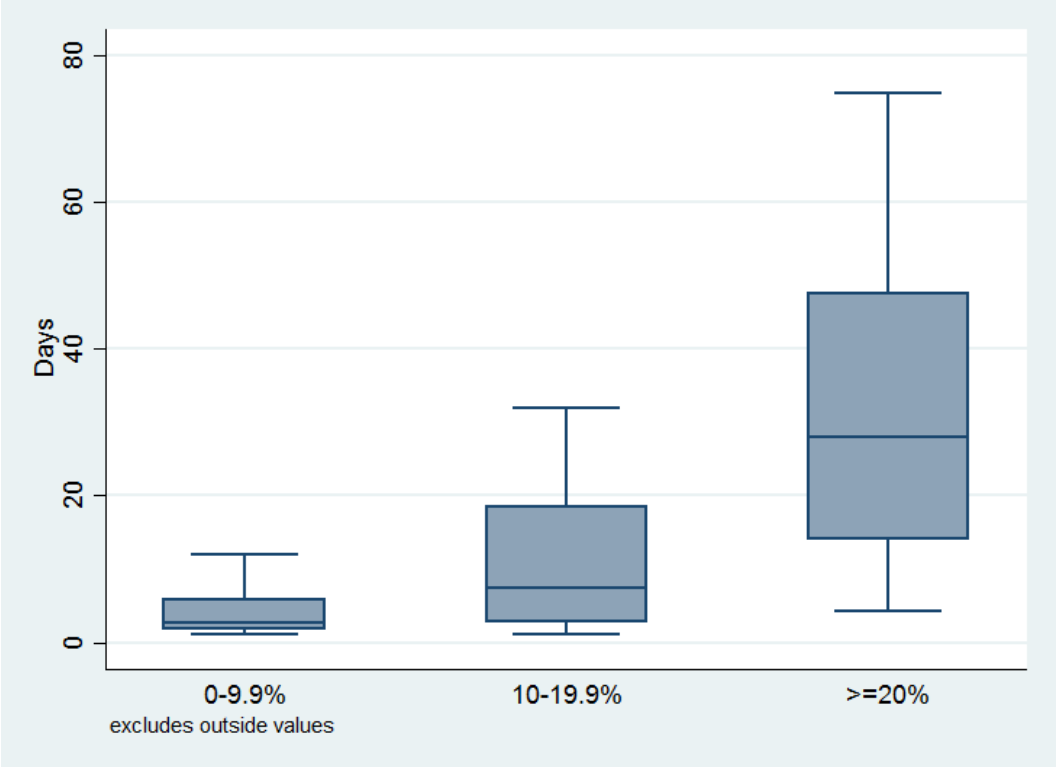
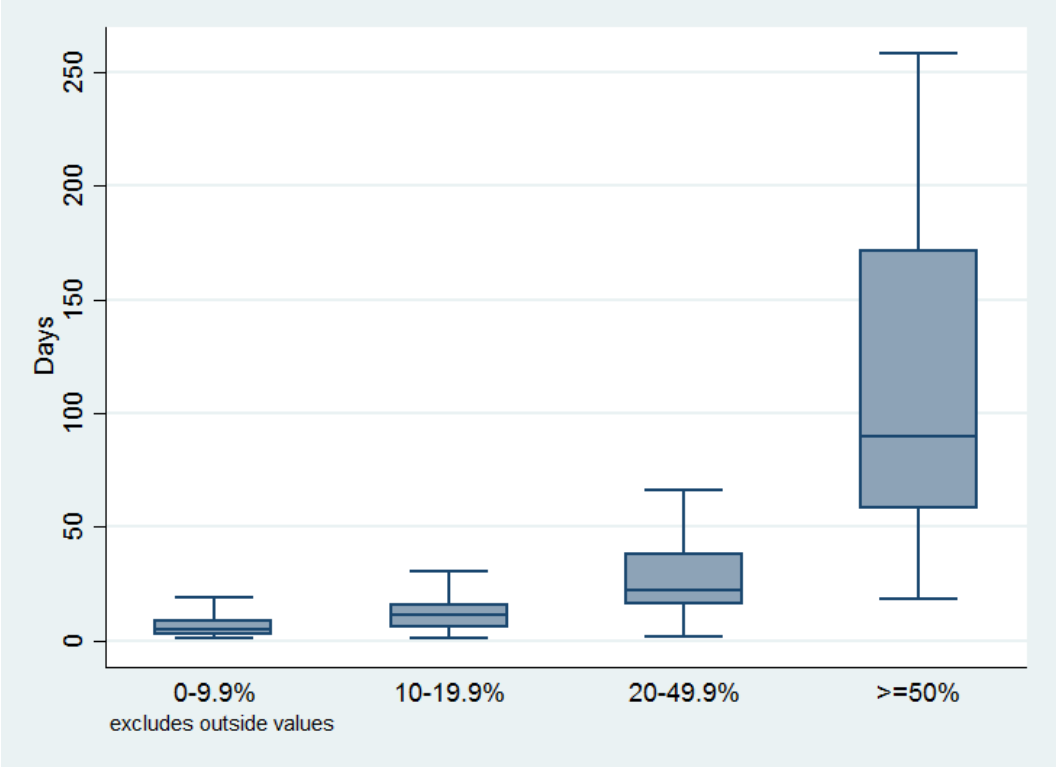


Figure 7b: Distribution of length of stay by percentage TBSA – Adult cases (excluding deaths)



Deaths

Overall, 49 (less than two per cent) patients died before hospital discharge. Of these patients, 47 were adults. This in-hospital death rate was lower than the reported American NBR death rate of three per cent, most likely reflecting the differences in the distribution of burn size noted earlier between the registries.

The proportion of patients who died generally increased with burn size. Of the 51 patients who had a TBSA greater than 50 per cent, 21 (41 per cent) died. This figure is lower than the previous reporting period (48 per cent). Of the patients who died, 53 per cent (n=26) had a documented inhalation injury.

A reason for death was recorded for all but one of the patients who died before hospital discharge, with burns shock (n=16) and multi-system organ failure (n=15) the most common reasons for death.

Of the 49 patients who died during their hospital stay, active treatment was not commenced for six of the cases. Active treatment was commenced but later ceased for 18 of the patients who died during their hospital stay. Fourteen of the 49 patients died within 24 hours of admission and the cause of death was recorded as burns shock or multi-system organ failure. The median (IQR) length of stay for patients who died during their hospital stay was 2 (1-9) days.

Discharge status

Most patients (87 per cent) were discharged to their usual residence, while 4 per cent were discharged to Hospital in the Home (Table 12). Transfer to another acute hospital or inpatient rehabilitation centre were other common destinations on departure from hospital.

Table 12: Discharge Disposition

Discharge Disposition	N	%
Usual residence/ home	2,861	87
Hospital in the Home	115	4
Inpatient rehabilitation hospital	77	2
Other acute hospital	61	2
Died	49	1
Other destination	43	1
Left against medical advice	30	1
Other health care accommodation	19	1
Another BRANZ hospital	18	1
Psychiatric hospital/Unit	16	<1

Readmissions

A total of 137 paediatric cases (14 per cent) were readmitted within 28 days of discharge and the majority (77 per cent) were reported as a planned readmission, which is consistent with previous reporting years. 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 years, the readmission rate was lower for adults. Only five per cent of adult cases (n=109) experienced a readmission within 28 days of discharge. In contrast to the paediatric patients, 49 per cent of these cases (n=54) 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.

Limitations and Data Caveats

- Only cases meeting BRANZ inclusion criteria are included in reports.
- Only the first acute admission that meets BRANZ inclusion criteria for a new burn injury is included in reporting. Readmissions (within 28 days of discharge) are excluded except when reported separately in the final section. If a patient is transferred between BRANZ hospitals, only the initial admission is included.
- Each record in the database represents a new burn injury. If an individual sustains multiple burn injuries on different occasions, they are included as separate records.
- Only valid responses to data items are included in the analysis. Missing data and items that have been classified as 'not stated/inadequately described' are reported on for completeness but excluded from analysis. Data items recorded as 'not collected for this patient', 'not collected at this site' are identified separately in the completeness report.
- Numbers with values less than five have been replaced by an asterisk (*) as a privacy protection measure.
- Dataset changes were required during the 2009 to 2010 reporting year to improve data completeness and data quality, which limits detailed comparison with earlier BRANZ reporting years. Therefore, this report has largely focused on comparisons after the 2010-2011 reporting period.
- Reporting against the clinical quality indicators is limited by the fact that standards of acceptable care have yet to be developed for many of the quality indicators. Data from this report, and the current work being undertaken to review and validate the quality indicators, will be used to develop standards of acceptable quality of care performance that will be monitored and benchmarked in the future.

Conclusion

Data are presented for 3,295 burn cases admitted to the 17 specialist burn units across both Australia and New Zealand for the 12-month period from 1st July 2016 to June 30th 2017. Consistent with the previous year, data completeness was 95 to 100 per cent for most core data items including the patient, burn event, admission, percentage TBSA, ICU and discharge details.

The demographic and aetiological profile of burn injury resulting in admission to Australian and New Zealand burns units was highly consistent with previous years. In particular, males aged 20 to 29 years were at high risk of sustaining a flame burn injury and children one year of age were at risk of sustaining a scald burn injury. These groups remain a high priority for injury prevention initiatives.

Cool running water was documented as being applied within three hours of injury for 77 per cent of all cases that received burn cooling at the scene of injury. Where an injury requiring admission to a burns unit occurred, the vast majority of burns were less than 10 per cent TBSA. However, 77 per cent of all cases required theatre for a burn wound management procedure, indicating the severity of even the smaller burns and the importance of injury prevention campaigns.

While quality of care data is presented in this report, comparisons against an acceptable standard of performance and between units are not currently being performed. Current evaluation and validation of the quality indicators is currently underway and will inform revision of these indicators, and the basis for benchmarking of burns unit performance.

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Glossary

Burn Depth:	Burns are described according to the depth of injury to the skin layers and are classified into superficial dermal, mid-dermal, deep-dermal and full thickness burns (26).
Burn Injury classifications (26)	• Chemical – direct contact with chemicals • Contact - direct contact with hot objects • Electrical – direct contact with an electrical current • Flame – direct contact with open flame or fire • Flash – exposure to the energy produced by explosive material • Friction – rapid movement of a surface against the skin, e.g. treadmill, road surface • Radiation – exposure to solar energy, radiotherapy, laser • Radiant heat – heat radiating from heaters , open fire places • Scald - hot liquids such as hot water and steam, hot fats, oils and foods
Country of Birth:	Country in which the person was born (27).
Definitive burn wound assessment:	The burn assessment documented by the most senior burns clinician assessment within 72 hours of admission. This definition was developed by the registry's Steering Committee in an effort to standardise burn wound assessment data, particularly given the percentage TBSA can be estimated and documented by numerous clinicians at multiple time points following burn injury.
Enteral / parenteral feeding:	**Enteral** nutrition is commonly administered through a nasogastric tube placed via the nose. **Parenteral** nutrition is administered via a peripheral or central vein. Enteral and parenteral nutritional supports are used to provide nutrients on a temporary or permanent basis to patients who are unable to ingest or tolerate adequate nutrients or to tolerate an oral diet (10).

Estimated glomerular rate (eGFR):	*'The glomerular filtration rate measures how well kidneys filter the waste products and toxins from a patient's blood and is the best indicated of kidney function. It helps determine if there is any damage.'* (28) The eGFR (estimated Glomerular Filtration Rate) is a test used to screen for and detect early kidney damage and to monitor kidney status. It is a quantifiable measure of acute renal failure and routinely recorded in patients admitted to intensive care units across Australia and New Zealand.
Ethnicity:	The ethnic group or groups that a person identifies with or feels they belong to. Ethnicity is a measure of cultural affiliation, as opposed to race, ancestry, nationality or citizenship (29).
Full thickness burns:	The most severe classification of burn depth where all skin layers are destroyed, leaving no cells to heal the wound. Full thickness burns are likely to require surgical excision and skin grafting (26).
Inhalation injuries:	Burns to the oropharynx and upper airway result in swelling and possible airway obstruction within the first few hours after injury. Inhalation of toxic products of combustion can result in early systemic effects or delayed inflammation of distal airways and alveoli with impaired gas exchange. Inhalation injuries are associated with significant morbidity and increased mortality, but have no agreed diagnostic criteria (30).
Senior burn clinician:	A burn surgeon who is the head of the unit or a surgeon with a minimum of two years' experience in a major burn unit who has Emergency Management of Severe Burns (EMSB) certification; or a Burns Nurse Practitioner with Emergency Management of Severe Burns (EMSB) certification.
Per cent Total Body Surface Area (TBSA) burn:	The common measure of area of burns of the skin. The two most common assessment tools used to assess the burn size are the 'Lund and Browder' and 'Rule of Nines' chart. As a general guideline the size of a person's hand print (palm and fingers) is approximately one per cent of their TBSA (26).

Appendix 1: Data Completeness

Within each section, the level of completeness of each data item is defined according to whether or not the section had data entered, or by the input of the 'not stated/adequately described 'option. Where data were not entered for an item or the option of not stated/not adequately described or not applicable or not collected for at site or not collected for that patient was selected, data were excluded from the reported analyses.

All data items are listed according to how they are entered on the database. The data item is expressed as a percentage of the total number of cases, or as percentage of the subset population if the data item is conditional on the response of another data item. For example, completeness of ICU data is only applicable to the patients who attended ICU.

100% complete 90-99% complete 80-89% complete < 80% complete

Patient Section	Complete and valid response	
	n	%
Date of Birth	3292/3292	100
Date of Injury	3292/3292	100
Gender	3292/3292	100
Ethnicity or Country of Birth	3256/3292	99
Residential Postcode	3270/3292	99

Admission Section	Complete and valid response	
	n	%
Admission Date/Time	3292/3292	100
Insurance or Fund Source	3292/3292	100
Presentation Type	3292/3292	100
Admission Type	3292/3292	100
Referral Source	1738/2704	100
Referral Centre Date/Time	2184/2189	64
Admitted via Outpatients	3290/3292	100
Is Patient a Burns Consult	3292/3292	100

Admission Section	Complete and valid response	
	n	%
Primary cause	3279/3292	100
Accelerant Involvement	3234/3292	98
Accelerant Type	609/633	96
Activity when burn injury occurred	3164/3292	96
Place where burn injury occurred	3155/3292	95
Intent when burn injury occurred	3274/3292	99
Injury Event Postcode	3092/3292	93
Drug/alcohol involvement	2799/3292	85
Inhalation injury	3280/3292	100

Burn Cooling Section	Complete and valid response	
	n	%
Was any first aid applied?	3064/3292	93
Was the first aid 20 minutes of cool running water within 3 hours of injury?	2371/2475	96

Burn Assessment Section (Burns Unit)	Complete and valid response	
	n	%
Was the burn size documented?	3277/3291	100
Assessment Date/Time	2986/3156	95
Assessed By	3001/3156	95
Burn depth recorded?	3150/3291	96
Superficial Dermal - Yes/No	2772/2982	93
Superficial Dermal %	1064/1073	99
Mid Dermal - Yes/No	2607/2982	87
Mid Dermal %	1134/1146	99
Deep Dermal - Yes/No	2589/2982	87
Deep Dermal %	1032/1043	99
Full Thickness - Yes/No	2752/2982	92
Full Thickness %	742/770	96

Assessment Quality Indicators Section	Complete and valid response	
	n	%
Theatre for burn wound management	3288/3292	100

Inpatient Section	Complete and valid response	
	n	%
ICU Admission	3273/3292	99
ICU Admission Date/Time	284/284	100
ICU Discharge Date/Time	284/284	100
Mechanical Ventilation	219/220	100

Discharge Section	Complete and valid response	
	n	%
Disposition from hospital	3288/3292	100
Discharge Date/Time	3292/3292	100

Appendix 2: Management Committee Membership

Belinda Gabbe	Monash University, DEPM	BRANZ Project Supervisor, Senior Research Fellow
Lincoln Tracy	Monash University, DEPM	BRANZ Research Fellow
Judith McInness	Monash University, DEPM	BRANZ Research Fellow
Mimi Morgan	Monash University, DEPM	Research Program Manager, Critical Care Division

Appendix 3: Reference & Steering Committee Membership

NAME	SITE	TITLE	Steering Committee	Reference Committee
Peter Cameron	Monash	Chief Investigator (Project Lead)	✓	
Belinda Gabbe	Monash	Chief Investigator (Project Supervisor)	✓	✓
Lincoln Tracy	Monash	Research Fellow	✓	✓
Judith McInnes	Monash	Research Fellow	✓	✓
Heather Cleland	VIC, Alfred	Head of Burns Unit / Acting Chair SC	✓	
Yvonne Singer	VIC, Alfred	Victorian State Burns Education Program Coordinator	✓	✓
Samara Rosenblum	VIC, Alfred			✓
Kathy Bicknell	VIC, RCH	Burns Co-ordinator	✓	✓
Roy Kimble	QLD, LCCH	Head of Burns Unit	✓	
Bronwyn Griffin	QLD, LCCH	Clinical Research Manager		✓
James Scott	NSW, Concord	Clinical Nurse Specialist		✓
John Harvey	NSW, CH Westmead	Head of Burns Unit	✓	
Siobhan Connolly	NSW, SBIS	Burns Prevention & Education Manager		✓
Anne Darton	NSW, SBIS	Burn Injury Service Manager	✓	✓
Andrew Castley	TAS, Royal Hobart	Head of Burns Unit	✓	
Rebecca Schrale	TAS, Royal Hobart	Clinical Nurse Consultant, Burns	✓	✓
Sheila Kavanagh	SA, RAH	Clinical Nurse Consultant	✓	
Sallyann McRae	SA, RAH	Burns Nurse		✓
Darren Nesbitt	SA, RAH	Burns Nurse		✓
Kathryn Heath	SA, RAH	Allied Health Project Manager, Burns SA/ Senior Dietitian, Surgical Specialties		✓
Linda Quinn	SA, WCH	Burns - Advanced Clinical Practice Consultant	✓	
Fiona Wood	WA, FSH	Head of Burns Unit (Past ANZBA President)	✓	

NAME	SITE	TITLE	Steering Committee	Reference Committee
Dale Edgar	WA, FSH	Senior Physiotherapist / Fiona Wood Foundation Director of Clinical Research (Past ANZBA President)	✓	
Sharon Rowe	WA, FSH	Clinical Nurse Consultant		✓
Tania McWilliams	WA, Princess Margaret	Clinical Nurse Consultant		✓
Lisa Martin	WA, Princess Margaret	Clinical Research Nurse, McComb Foundation		✓
Margaret Brennan	NT, Royal Darwin	CNC Inpatient Burn Service	✓	✓
Tracey Perrett	NZ	National Burn Service Coordinator	✓	✓
Richard Wong She	NZ, Middlemore	Head of Burns Unit	✓	
Margaret Conaglen	NZ, Christchurch	Nurse Educator		✓
Hilary Neighbours	NZ, Hutt Valley	Associate Clinical Nurse Manager		✓
Bethany Farley	Julian Burton Burns Trust	Manager, Projects and Programs	✓	

Appendix 4: BRANZ Data Collectors

NAME	STATE	SITE	TITLE
Samara Rosenblum	VIC	Alfred	Data Collector Burns Registry
Kathy Bicknell	VIC	Royal Children's	Burns CNC
Bronwyn Griffin	QLD	Lady Cilento Children's Hospital	Clinical Research Manager
Teresa Matthews	QLD	Royal Brisbane & Women's	Data Manager
Tania Edwards	NSW	Concord	Data entry clerk
Jackie Maitland	NSW	Royal North Shore	Burns receptionist
Anne Laguthaas	NSW	Westmead Children's	Data entry clerk
Rebecca Schrale	TAS	Royal Hobart	Burns CNC
Sallyann McRae	SA	Royal Adelaide	Burns Nurse
Lois Robinson	SA	Women's & Children's	Data entry clerk
Graeme McLeod	WA	Fiona Stanley	Burns MDT Facilitator
Penelope Cox	WA	Fiona Stanley	Burns Nurse
Lisa Martin	WA	Princess Margaret	Research Nurse
Margaret Brennan	NT	Royal Darwin	A/ Burns Unit CNM
Briccio Bartolome	NT	Royal Darwin Hospital	A/ Burns CNC
Dave Jacinto	NT	Royal Darwin Hospital	A/ Burns CNC
Mandy Arnett	NZ	Christchurch	Ward Clerk
Louise Le Grelle	NZ	Christchurch	Burns Nurse
Hilary Neighbours	NZ	Hutt Valley	ACN Manager
Rachel Cameron	NZ	Hutt Valley	ACN Manager
Anne-Marie Yaxley	NZ	Hutt Valley	Burns Nurse
Dhevindri Moodley	NZ	Hutt Valley	Paediatric Nurse
Hannah Will	NZ	Waikato	Burns Nurse Specialist
Christine Wilson	NZ	Waikato	Administrator
Rebecca Lee	NZ	Middlemore	Burns Nurse
Tu'upoloa Ng-Wun	NZ	Middlemore	Ward Clerk

Appendix 5: BRANZ 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 (Table 14). Of these sites, five sites treat paediatric patients only, six sites treat adult patients only, and six sites treat both paediatric and adult patients.

Table 14: Australian and New Zealand BRANZ Hospitals with Ethics Approval

Hospital	State/Country	Adults/Paediatrics
The Alfred	Victoria	Adults
Royal Children's	Victoria	Paediatrics
Princess Margaret	Western Australia	Paediatrics
Fiona Stanley	Western Australia	Adults
Royal North Shore[1]	New South Wales	Adults
Concord General Repatriation[1]	New South Wales	Adults
Children's Hospital Westmead[1]	New South Wales	Paediatrics
Women's & Children's	South Australia	Paediatrics
Royal Adelaide	South Australia	Adults
Royal Brisbane and Women's	Queensland	Adults
Lady Cilento	Queensland	Paediatrics
Royal Hobart	Tasmania	Adult/Paediatrics
Royal Darwin	Northern Territory	Adult/Paediatrics
Middlemore[2]	Auckland, NZ	Adults/Paediatrics
Christchurch[2]	Christchurch, NZ	Adult/Paediatrics
Waikato[2]	Hamilton, NZ	Adult/Paediatrics
Hutt[2]	Wellington, NZ	Adult/Paediatrics

[1] *NSW burns units form the NSW Statewide Burn Injury Service (SBIS).*

[2] *The National Burn Centre (NBC) at Middlemore hospital and the Regional Burn Units (Christchurch, Waikato, and Hutt) form the National Burn Service (NBS) for New Zealand.*

Appendix 6: Australia and New Zealand Burns Websites

Hospital/Unit/Service		Website
The Alfred Hospital	VIC	http://www.alfredhealth.org.au/burns_unit/
Royal Children's Hospital	VIC	http://www.rch.org.au/burns/clinical_information/
Victorian Burns Units	VIC	http://www.vicburns.org.au
Fiona Stanley Hospital	WA	http://www.fsh.health.wa.gov.au/Our-services/Service-Directory/Burns
Princess Margaret Hospital	WA	http://www.pmh.health.wa.gov.au/general/about_us/
Royal North Shore Hospital	NSW	http://www.nslhd.health.nsw.gov.au/Hospitals/RNSH
Concord General Repatriation Hospital	NSW	https://www.slhd.nsw.gov.au/concord/Burns_about.html
Children's Hospital Westmead Hospital	NSW	http://www.schn.health.nsw.gov.au/parents-and-carers/our-services/burns/chw
NSW Statewide Burn Injury Service	NSW	www.aci.health.nsw.gov.au/networks/burn-injury
Women & Children's Hospital	SA	http://www.wch.sa.gov.au/services/az/divisions/psurg/burns/
Royal Adelaide Hospital	SA	http://www.rah.sa.gov.au/burns/
Lady Cilento Hospital	QLD	https://www.childrens.health.qld.gov.au/referapatient/list-specialities/burns/
Royal Brisbane & Women's Hospital	QLD	http://www.health.qld.gov.au/rbwh/services/burns.asp
Royal Hobart Hospital	TAS	http://www.dhhs.tas.gov.au/service_information/services_files/RHH
Royal Darwin Hospital	NT	http://www.health.nt.gov.au/Hospitals/Royal_Darwin_Hospital/
Middlemore Hospital	NZ	http://www.nationalburnservice.co.nz/
Christchurch Hospital	NZ	http://www.cdhb.govt.nz/nursing/surgical/ward20.htm
Waikato Hospital	NZ	http://www.waikatodhb.govt.nz
Hutt Hospital	NZ	http://www.huttvalleydhb.org.nz

Appendix 7: Report of Structural Quality Indicators

Structural quality indicators describe the attributes of a setting in which health care occurs. These include the resources available such as adequate building, equipment, qualifications and the availability of staff. Structural indicators are linked to a process of care that has a direct link to an outcome of care. The following structural indicators included in BRANZ have been reported in previous annual reports and are currently under review for further clarification and amendment. Data was received from nine of the 17 sites (53 per cent response rate) and the questions required a yes/no response only. The response rate for this reporting period was greater than that of the previous reporting period (29 per cent response rate).

STRUCTURAL QUALITY INDICATORS	Number of centres that responded	Yes (n)	Yes (%)
1. Is a Burns Surgeon available on call 24 hours?	9	7	78
2. Is a Burns theatre available on a 24-hour basis?	9	7	78
3. (a) Is Multidisciplinary care provided within the Burns unit?	9	9	100
(b) Are weekly multidisciplinary team meetings Conducted in the burns unit?	9	9	100
4. Does your unit routinely complete infection Surveillance swabs on admission?	9	6	67

Appendix 8: ANZBA Referral Criteria

ANZBA
Australian & New Zealand Burn Association

Care • Prevention • Research • Education

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 per cent of total body surface area (TBSA);
- burns of special areas—face, hands, feet, genitalia, perineum, and major joints;
- full-thickness burns greater than five per cent of TBSA;
- electrical burns;
- chemical burns;
- burns with an associated inhalation injury;
- circumferential burns of the limbs or chest;
- burns in the very young or very old, or pregnant;
- burns in people with pre-existing medical disorders that could complicate management, prolong recovery, or increase mortality;
- burns with associated trauma; and
- Non-accidental burns