



MCKELL INSTITUTE VICTORIA

Burns care in Victoria

DECEMBER 2021

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ABOUT THE REPORT

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This report was written on the lands of
Wurundjeri people of the **Kulin Nations**.

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FOREWORD

Victoria is sadly no stranger to catastrophic fire events, the devastating injuries they can cause, and our health system preparedness for such events is always critically important. While many of us associate burns with fires, the leading causes of burn injuries for Victorians are much more commonplace.

Whether it's cooking at the stove, connecting the barbeque, or working with chemicals, fats and oil, or electrical currents, a small slip can result in burn injuries that have severe consequences.

The everyday nature of most burn injuries, combined with the seriousness of the treatment and health outcomes, warrants greater attention in our health system. Burn injuries cause the longest hospital stays in Australia. This report is designed to shine a light on how our current health system supports burns patients and compares that support to international best practice. Our findings show there are gaps between what's best and what we currently have here in Victoria to care for patients with burn injuries. Our services can be improved, and this report makes a clear case for why action is required to improve health outcomes of burn patients.

Burns specialists work in unique conditions – best practice recommends closed, temperature variable operating theatres and thermally controlled wards. Hot conditions for medical staff can help protect patients but can be uncomfortable to work in. Given the sensitivity of skin trauma, ongoing risk of infection is high during recovery. Once healed, skin scars remain and require careful management. The health system could better support the efforts of these doctors, nurses and allied health professionals.

Burn injuries are a small but serious part of our health and hospital system. In Victoria our burn care services are good but could be a whole lot better. The recommendations in this report are the sort of health service improvements you never knew you needed until you do. Or you loved one does.

Here at the McKell Institute Victoria we are continually striving to produce research that can benefit the lives of everyday Victorians, at home or at work. We are fortunate to have received generous philanthropic support to enable this project to come to fruition. We hope this report can raise awareness of these issues and lead to improvements for the future.



EXECUTIVE SUMMARY

Every year, over 5,000 patients present to Emergency Departments throughout Victoria with burn injuries. Currently, these patients are forced to navigate a fragmented burns-care system that contradicts international guidelines, causes unnecessary handovers and provides little continuity of care.

Burn patients arriving at emergency departments are typically burned in everyday circumstances. Cooking with hot fluids and working with hot substances are major causes of hospitalised burns. Whilst these activities appear benign, the injuries sustained are often the most serious, and account for a considerable burden to the health system. In Australia, the hospital length of stay for a burn injury is greater than any other injury.

Unfortunately, burn patients are more likely to include Australia's most vulnerable populations: Aboriginal Australians, the elderly, and those living in remote areas are all overrepresented among hospitalised burn victims.

Unlike North America, Britain, and Europe, Australia has no guidelines to specify how burn units should be resourced and staffed, and no verification process to ensure burn care is being delivered by appropriate facilities. As a result, the quality of care offered between states is extremely variable.

Victoria's burn response is led by the Victorian Adult Burns Service located at the Alfred Hospital. The service faces major structural issues. Contradicting international guidelines, the unit is housed in an open ward shared with many other subspecialties and does not have access to facilities recommended by burn associations and researchers. Without access to a purpose-built closed facility, burn patients must move through separate wards to receive emergency treatment, burn care, surgery, intensive care, rehabilitation, and outpatient care.

This fragmentation causes disruptions in burn patients' recovery and creates unnecessary risks for infection. When burns patients are cared for all over the hospital there is no focus, nor consistency, and treating clinicians may have little expertise in burns. There are many avoidable handovers in a burn patient's journey within the Victorian system, and with every handover something is lost, something changed and much risked. Research demonstrates that patients who are treated at comprehensive burn centres experience fewer emergency department visits, fewer hospital readmissions, and a lower need for subsequent unplanned acute care.¹

Across the world, burn associations advocate for stand-alone burn centres with specialised staff, purpose-built facilities that provide continuity of care, and an associated laboratory to conduct innovative translation research.

Victoria's burn service requires reform. This report argues that the Victorian Government should fund a business case to build a purpose-built burn centre that heeds international recommendations. A new burn centre would improve the quality of burn care in Victoria, save money by decreasing hospital length of stay, and expand Victoria's growing research into burns treatment.

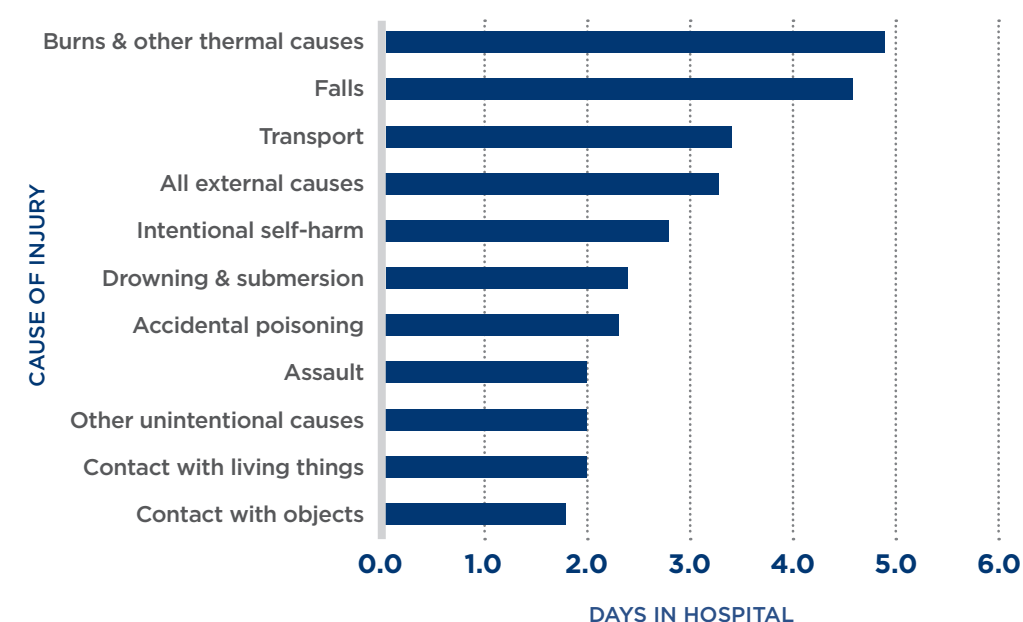
BURNS INJURY IN AUSTRALIA

Burns are one of the most devastating injuries, causing the longest hospital stays in Australia

Burns are one of the top causes of death and disability in the world.² In Australia, burn injuries make up a small fraction (1%) of all injury hospitalisations, but are often the most serious injuries, and account for a considerable burden to the health system.

The severity of an injury is typically measured by hospital length of stay, percentage of cases with time in an intensive care unit (ICU), and percentage of cases involving continuous ventilator support.³ As seen in Figure 1, the average duration of a hospital stay for a burn injury is the longest of any of any type of injury in Australia. Moreover, the percentage of burn injuries that required time in an ICU (2.9%) and/or involved continuous ventilator support (1.9%) are greater than the average of all hospitalised injuries (2.4%, and 1.2%, respectively).³ Typically, a shorter length of stay in hospital, ICU, and ventilator support is considered more efficient from a health system perspective, as this creates more capacity for other patients and reduces the burden on the healthcare system.⁴

FIGURE 1
AVERAGE NUMBER OF DAYS IN HOSPITAL BY CAUSE OF INJURY, AUSTRALIA, 2017-18

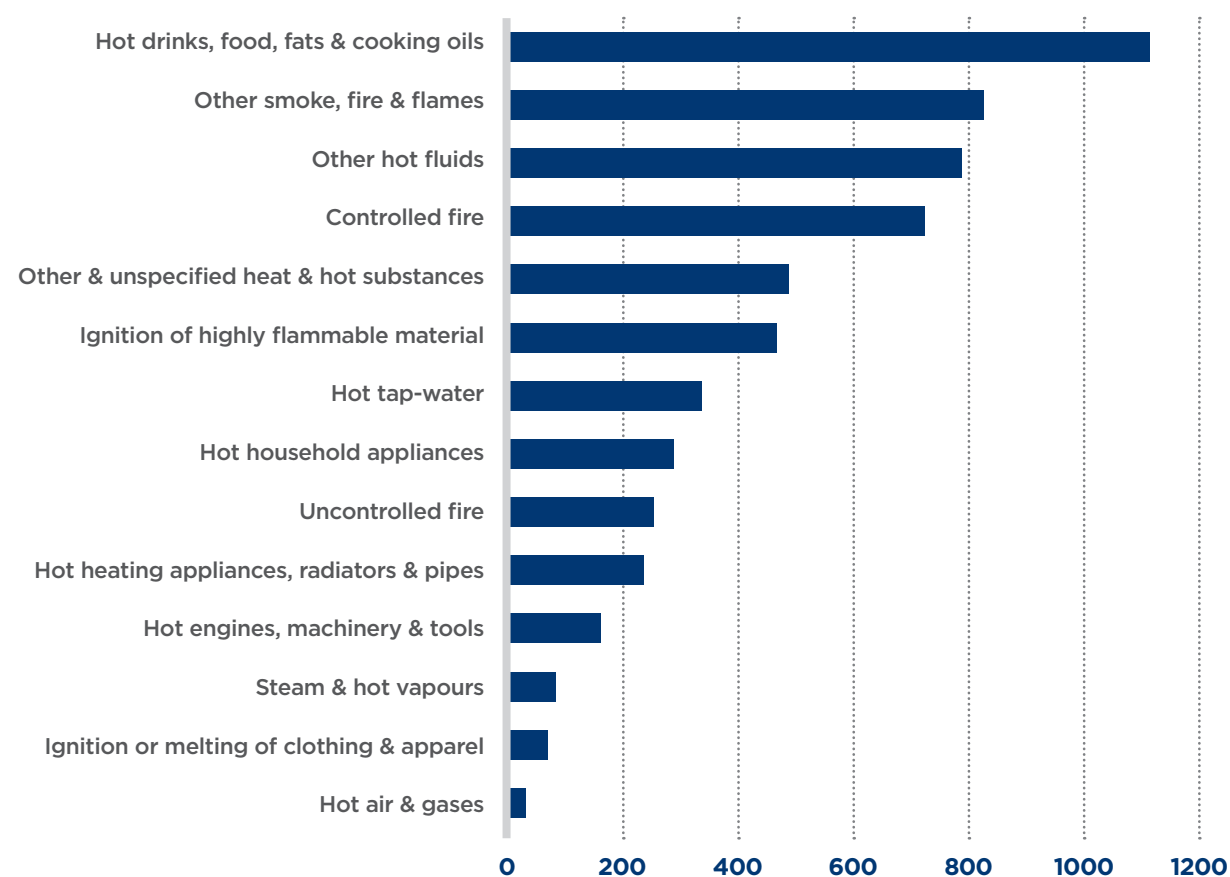


Source: AIHW National Hospital Morbidity Database.

Burn injuries have serious, long-term effects

Because of the complex and traumatising nature of burn injuries, burn survivors face significant challenges after being released from hospital. A recent Victorian study found that at 12 months after a burn injury, most patients reported levels of physical functioning that were significantly below their pre-injury levels. Additionally, patients still had significantly lower levels of energy and much greater levels of fatigue.⁵ Other research has found that a majority of patients report symptoms of depression and anxiety, including PTSD, even two years post discharge.^{6,7,8}

FIGURE 2
NUMBER OF HOSPITALISED INJURY CASES DUE TO BURNS AND OTHER THERMAL CAUSES, BY CAUSE, AUSTRALIA, 2017-18



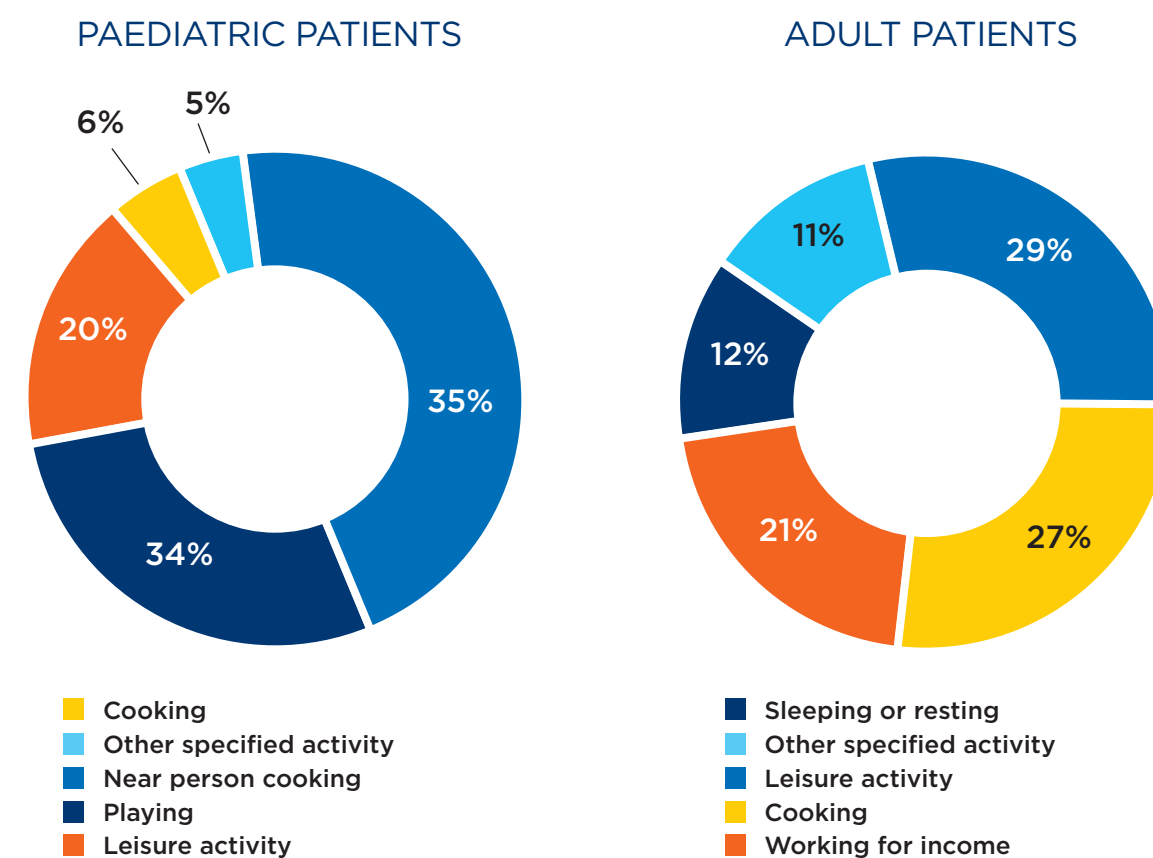
Source: AIHW National Hospital Morbidity Database.

Hospitalised burns often occur in 'everyday' circumstances

Contact with hot drinks, food, fats and cooking oils is the most common cause of hospitalised burn injuries, for children and in general.³ Of burns with a recorded place of occurrence, over two thirds (68%) of hospitalised burn injuries occur in the home. The next common place for a burn injury to occur is a trade and service area (7%).⁹

Burns commonly occur whilst individuals are doing everyday activities. Among children admitted to a burn unit in Australia and New Zealand, being near a person cooking, playing, or participating in a leisure activity were the most common activities at the time of injury. For adults, the most common injuries were participating in a leisure activity, cooking, and working.¹⁰

FIGURE 3
FIVE MOST COMMON ACTIVITIES AT TIME OF INJURY IN REGISTERED BRANZ PATIENTS, 2019-20



Source: BRANZ 2019-20

Burn care is expensive

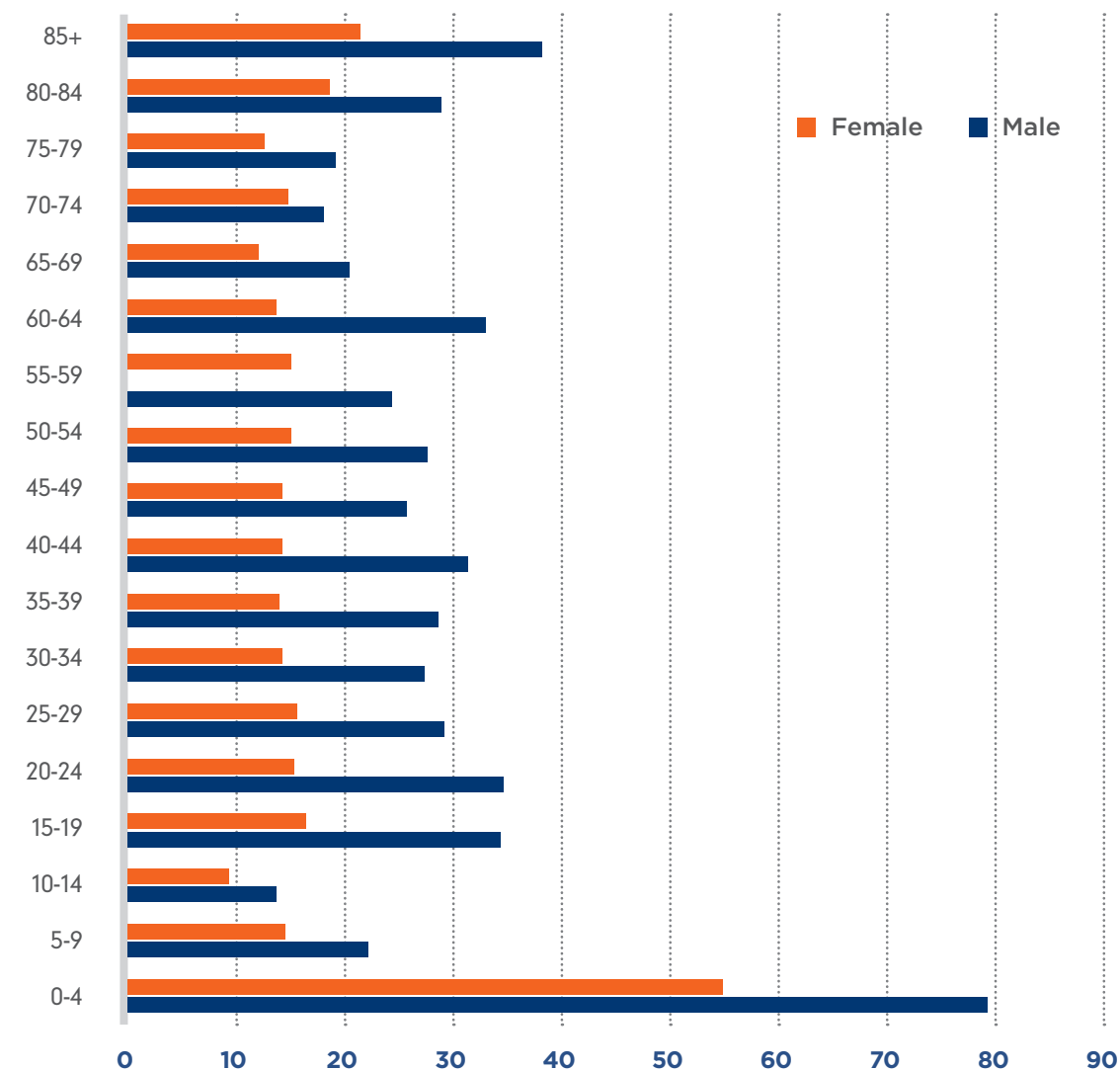
The costs associated with treating burns patients are high.^{11,12,13} Dressing changes, operations, rehabilitation and psychological counselling are just some aspects of treatment that these patients must endure. A recent study from Western Australia compared the cost of burn patients to a cohort of individuals without injury over twelve years. The study found that the burn cohort had 2.48 times the rate of hospitalizations after burn, 5.79 times the length of stay in hospital and 2.77 times higher hospital costs.¹⁴ A Victorian study found that the average cost per inpatient admission for an unintentional burn injury was AU\$11,194.¹⁵ For a severe burn, the average cost is much higher (\$87,570), but has considerable variability.¹⁶

Older, male, and Aboriginal Australians are more likely to be hospitalised and die due to burns

Existing Australian data shows that at every age bracket, men are more likely to be hospitalised and die due to a burn injury. Younger Australians (aged 0-4) are also more likely to be admitted to hospital due to a burn injury, however a greater proportion of burn injury deaths occur in older individuals. Between 2008-18, people aged 65 and over accounted for 33% of all burn injury deaths.³

Aboriginal Australians are also 2.7 times as likely as non-Aboriginal Australians to be hospitalised due to a burn injury. Between 2017-18 there were 1.8 deaths per 100,000 Aboriginal Australians due to burns and other thermal causes. This rate was only 0.4 amongst non-Aboriginal Australians.³

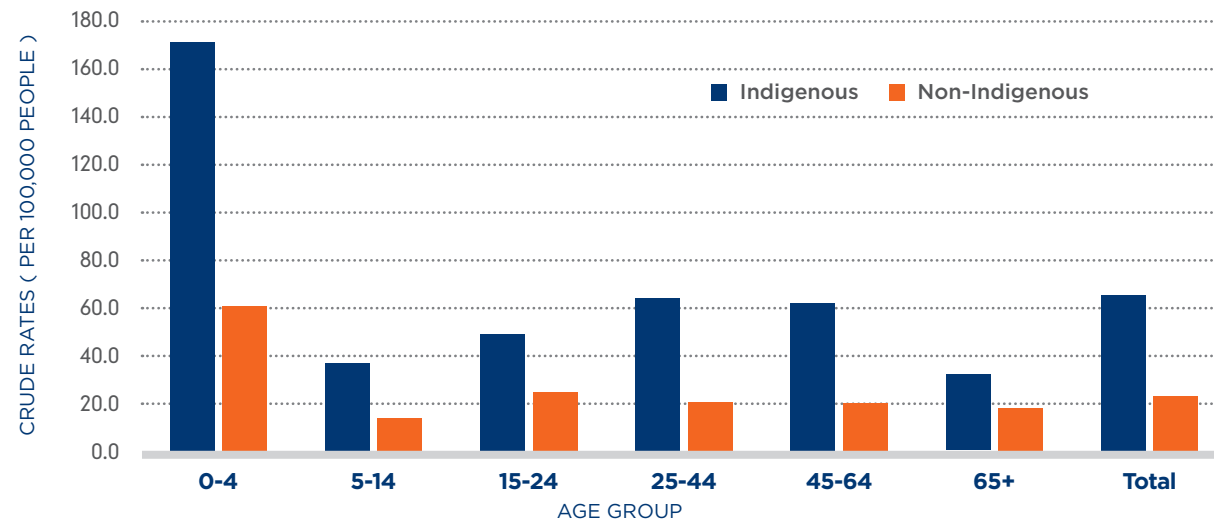
FIGURE 4 CRUDE RATES OF HOSPITALISED INJURY CASES, FROM BURNS AND OTHER THERMAL CAUSES, BY AGE GROUP AND SEX, AUSTRALIA, 2017-18



Source: AIHW National Hospital Morbidity Database.



FIGURE 5 CRUDE RATES OF HOSPITALISED INJURY CASES FROM BURNS AND OTHER THERMAL CAUSES BY INDIGENOUS STATUS AND AGE GROUP, AUSTRALIA, 2017-18



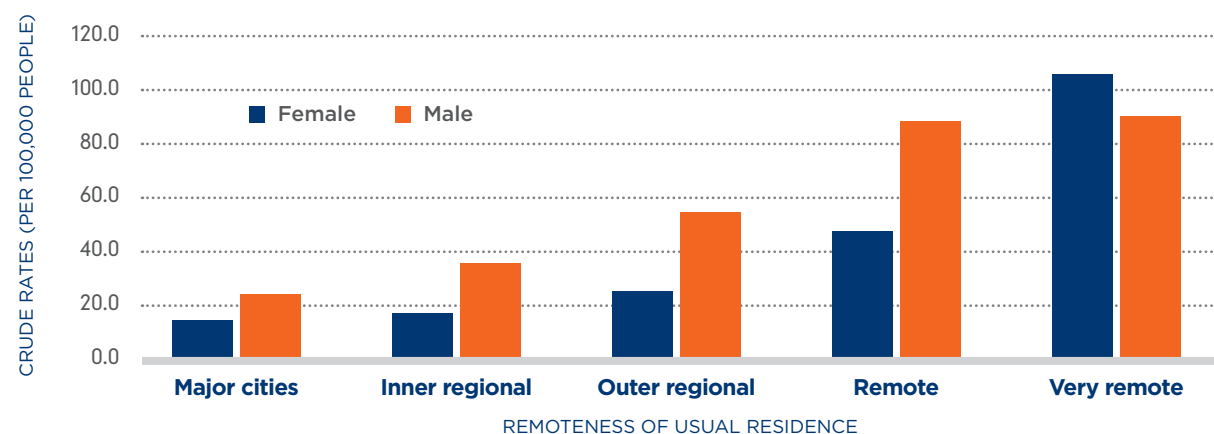
Source: AIHW National Hospital Morbidity Database.

More people are hospitalised due to burns in major cities, but the likelihood of hospitalisation and death increases with remoteness

In 2017-18, people living in 'very remote areas' were 4.9 times more likely than people living in major cities to be hospitalised by a thermal injury.³ Additionally, research has found that burn injuries amongst children living in Australian rural regions are larger, more severe, and require more complex procedures, when compared to burn injuries amongst children from metropolitan areas.¹⁷

Patients from remote areas also face difficulties receiving outpatient rehabilitation services, as a number of the support services required by burns survivors, such as physiotherapy and peer-support, are not available in rural and remote communities. However, recent developments in delivering burn treatments via telehealth have facilitated long-distance specialist reviews of burn wounds, which have been especially beneficial for rural and remote burn survivors.^{18,19}

FIGURE 6 CRUDE RATES OF HOSPITALISED INJURY CASES FROM BURNS AND OTHER THERMAL CAUSES BY INDIGENOUS STATUS AND AGE GROUP, AUSTRALIA, 2017-18



Source: AIHW National Hospital Morbidity Database.

Almost one in five working-aged patients admitted to burns centres had work-related injuries

Burn injury data from 2009-2016 demonstrates that 17% of all burn injuries admitted to Australian and New Zealand burn centres were work related.²⁰ Examining statistics for Victoria specifically, WorkSafe data shows that over 150 burn-related compensation claims are made by Victorians each year.²¹ The Australian data suggests that most work-related cases were male (85%), and were less than 35 years old (53%). The

highest proportions of work-related burns were sustained in trade and service areas, industrial and construction sites, and farms. A majority of workers with burn injuries were employed in industries specified as 'other specified', followed by manufacturing, construction and wholesale and retail trade.²⁰ To better understand the nature of workplace accidents, source data collection should be improved to more accurately disaggregate the categorisation of industries, to reduce the number of work-related burns attributed to 'other specified' industries, and enable more effective prevention activities.

FIGURE 7 NUMBER AND PERCENTAGE OF WORKERS COMPENSATION CLAIMS THAT RESULT FROM BURN INJURIES, 2010-2019

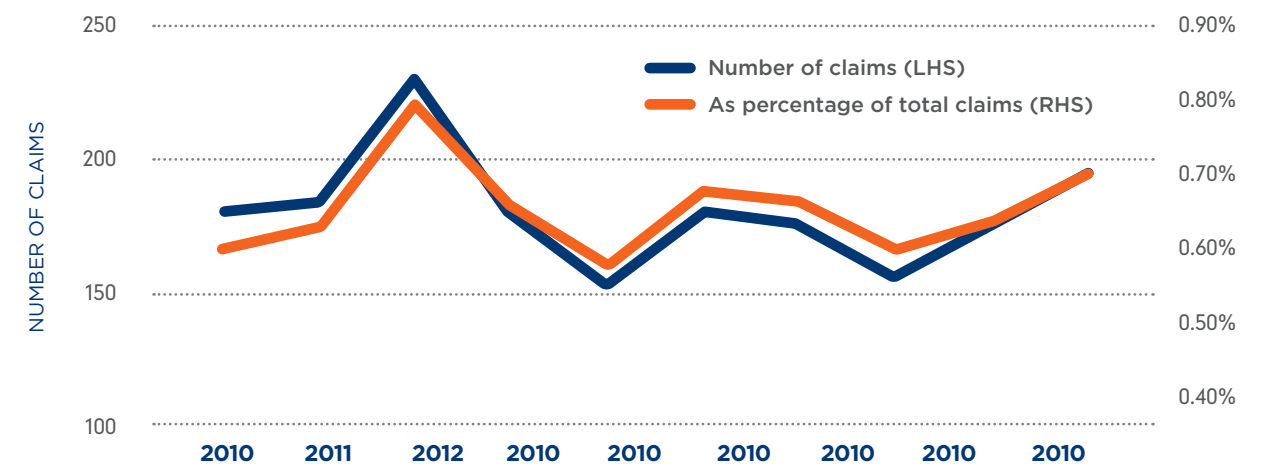
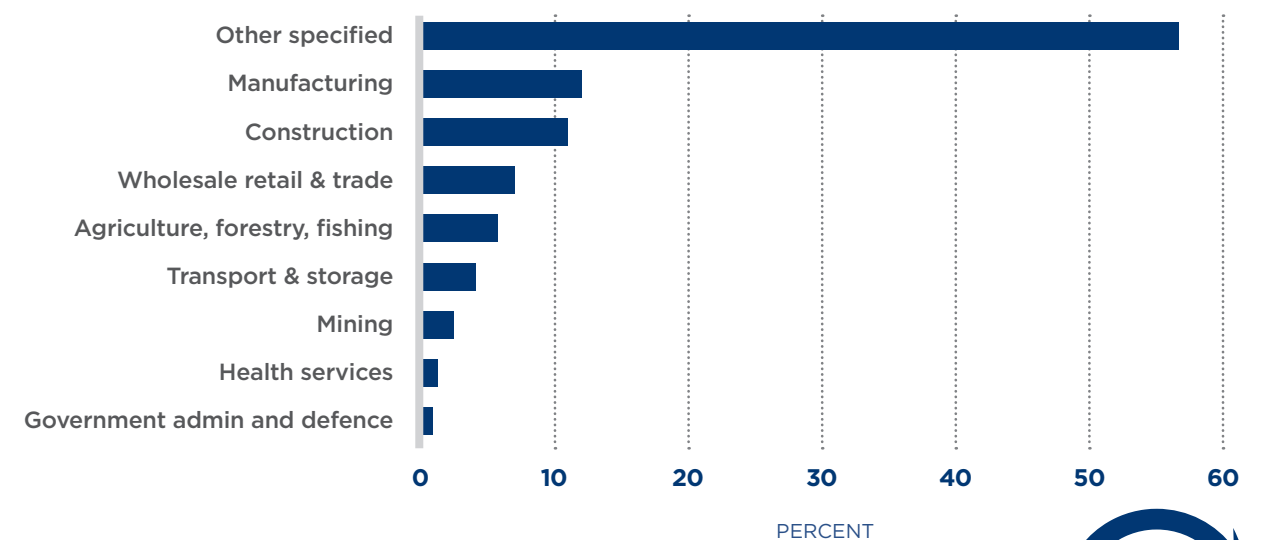


FIGURE 8 PERCENTAGE OF WORK-RELATED BURN INJURIES ACCORDING TO INDUSTRY, 2009-2016.



AUSTRALIA'S BURN CARE SYSTEM

Australia has 13 designated units for treating significant burn injuries.

Australia's burn units were developed to provide specialised care to patients with severe burn injuries.¹⁰ Each Australian state has at least one adult burn unit, and all states except Tasmania and the Northern Territory have a paediatric burn unit. In accordance with the Australian and New Zealand Burn Association's (ANZBA) referral guidelines, all patients with significant burn injuries are transferred to the closest appropriate burn unit, whilst less severe burns are treated at local hospitals.²³ Unlike in the USA and the UK, there are no service standards for burn units, in terms of organisation, staffing, facilities, or workload.^{24,25}

FIGURE 9 LOCATION OF AUSTRALIA'S 13 DESIGNATED BURN UNITS

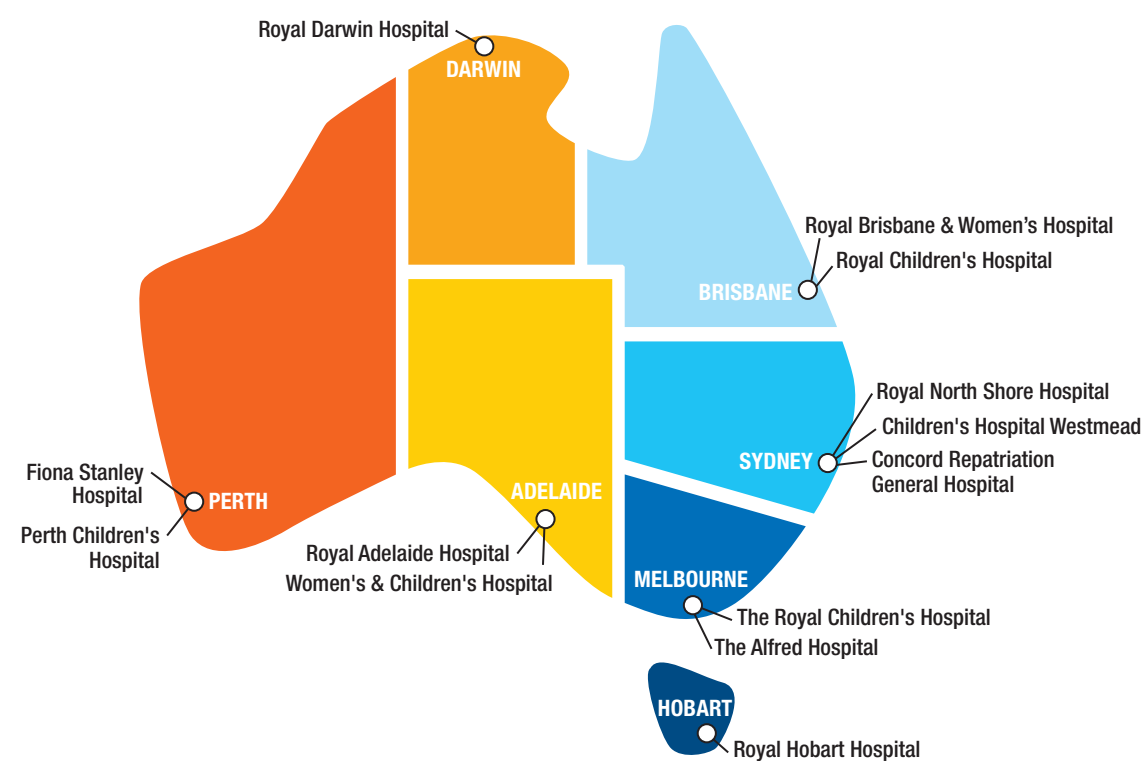


TABLE 1 LIST OF BURN UNITS IN AUSTRALIA

STATE	NAME	SERVICE
New South Wales	Royal North Shore Hospital Burns Unit, Royal North Shore Hospital	Adult
	Concord Hospital Burns Unit, Concord Repatriation General Hospital	Adult
	Children’s Hospital Westmead Burns Unit, Children’s Hospital at Westmead	Paediatric
Victoria	Victorian Adult Burn Service, The Alfred Hospital	Adult
	Royal Children Hospital Burn Unit, Royal Children’s Hospital	Paediatric
Queensland	Professor Stuart Pegg Adult Burns Centre, Royal Brisbane and Women’s Hospital	Adult
	Pegg Leditschke Children’s Burns Centre, Queensland Children’s Hospital	Paediatric
South Australia	The Adult Burn Service, Royal Adelaide Hospital	Adult
	The Women’s and Children’s Hospital Paediatric Burns Service, Women’s and Children’s Hospital	Paediatric
Western Australia	State Adult Burn Unit, Fiona Stanley Hospital	Adult
	Perth Children’s Hospital Burns Service, Perth’s Children Hospital	Paediatric
Northern Territory	Royal Darwin Hospital Burn Unit, Royal Darwin Hospital	Adult
Tasmania	The Tasmanian Burns Unit, Royal Hobart Hospital	Adult



STRENGTHS OF AUSTRALIA’S BURN CARE SYSTEM

Australia’s regionalised burn’s structure is aligned with international recommendations

Researchers and burns associations agree that in high-income countries with a low incidence of burn injuries, a national burns structure with fewer, larger centres will provide the best care in a cost-effective manner. High-standard burn care requires specialised equipment, well-trained multidisciplinary staff, and community outreach programs, and these are all more easily maintained in large burn centres that care for a greater number of patients.²⁶ Whilst there has been no economic modelling on the best number of burn centres for a population, researchers believe optimal resources would factor one burn centre for 5 to 5.5 million population.^{26,27} In their *Practice Guidelines for Burn Care*, The International Society for Burn Injuries note that “centralizing burn care with the establishment of burn centres has certainly improved treatment outcomes” (p. 1694).²⁸

High-quality data on burn incidents and outcomes is collated by the Burns Registry of Australia and New Zealand (BRANZ)

Obtaining high-quality data on the extent of the problem of burn injury is vital to inform burns practice, prevention and education programs. To this end, the Burns Registry of Australia and New Zealand (BRANZ) was developed in 2009. BRANZ is a clinical quality registry that captures epidemiological, quality of care, and outcome data for adult and paediatric burn patients across Australian and New Zealand burn units. The information collected by BRANZ provides a unique opportunity for significantly improving the quality of care for burns patients in Australia and New Zealand.²⁹

Australia has a number of national and state burns support groups

Australian burns support groups include the Burns Survivor Network and the Burns Support foundation. These groups provide services and programs to assist burn survivors and their families to develop a quality of life beyond survival. Research has revealed strong positive views regarding the helpfulness of peer support: burn survivors report that peer supporters provide a sense of belonging and affiliation and give hope and confidence.³⁰ Whilst Australia is lucky to have numerous burn support groups, these groups have been described as fragmented and underutilised by burns survivors.³¹

WEAKNESSES OF AUSTRALIA’S BURN CARE SYSTEM

Australia does not have high-standard outcomes for burn patients, in terms of length of stay or mortality rates

LENGTH OF STAY

Length of stay is used to indicate quality of burn care, as it is an indirect indicator of morbidity associated with burns and a direct indicator of cost of treatment.³² Evaluations tend to express length of stay as a function of burn size (days/%TBSA), as this allows direct comparison between populations, and can also be used as an indicator of the efficiency of burn care. Currently, in Australian burn units, length of stay increases by approximately one day for each additional percentage of body surface area burned.¹⁰ Whilst this is consistent with ratios reported internationally,³³ a ratio below 1 is the goal for burn treatment.³²



MORTALITY

In Australia and New Zealand, in-hospital deaths account for only 1% of patients in burn units between 2019-20.¹⁰ This is below the mortality rate in the US, which is 3%.³³ However, US burn centres tend to treat a patient cohort with slightly more severe burns. For example, 83% of burn patients in the Australian dataset sustained a burn below 10% TBSA, but only 78% of cases in the US dataset had a burn below this threshold.^{10,33}

Additionally, Australian in-hospital death rates increase significantly when examining patients with severe burns. For Australian patients with burns that cover 20% or more of their total body surface area, the mortality rate increases to 17%.³⁴ This rate is towards the higher end when compared to international mortality rates of comparable patient populations: a review of European burns care found average mortality rates between 1.4% and 18% in hospitalized populations with severe burn injuries.³⁵

Infections are on the rise

Infection is a common complication of burn injury caused by the loss of skin (the primary defence against micro-organisms) as well as burn-induced immunosuppression. Essentially, survival after burn injury is determined by whether wound healing or infection dominates. Infection is still the major cause of death in burns patients.³⁶

Two current concerns in burn care include bloodstream infections, which are associated with increased risk of mortality in burns patients, and multi-drug resistant organisms, which can be an indicator of hand hygiene practices, overuse of antibiotics, and poor clinical management, and can lead to prolonged hospital stays.^{36,37} Blood cultures are used to detect infections that may spread through the bloodstream of patients. As seen in Table 3, data from Australia's burn units suggest that the rate of positive blood cultures, and to a lesser extent multidrug resistant organisms, are increasing over time in burn patients in Australia.¹⁰ Multidrug resistant organisms appear to be particularly problematic in Victoria: data collected by the Victorian Adult Burns Service found that around 11% of all inpatients acquire a multidrug resistant organism throughout their stay.¹⁶

TABLE 2 PERCENTAGE OF TESTED BURN PATIENTS IN AUSTRALIA WITH AT LEAST ONE POSITIVE BLOOD CULTURE, AND A POSITIVE SWAB FOR METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS; THE MOST COMMON MULTIDRUG RESISTANT ORGANISM, OVER TIME.

	POSITIVE BLOOD CULTURES		MULTIDRUG RESISTANT ORGANISM	
	ADULT	CHILD	ADULT	CHILD
2019-20	17	13	3	5
2018-17	15	7	9	2
2017-16	8	3	2	3
2016-15	4	<1	NA	NA

Burn care differs extensively between Australian burn units

A recent report analysed 4 years of BRANZ data from July 2010 to June 2014 to examine whether burn units differ in their management and outcomes of burns patients. The study identified considerable variation in practice and outcomes that are not explained by simple differences in case-mix alone.³⁸

The authors found significant differences between units in skin grafting rates, which is notable, as this form of surgical management can reduce long term scarring outcomes. The mean adjusted hospital length of stay also differed by more than 2 days between burn units. This flags the need for some units to pay attention to variables that influence length of stay, such as time to surgery and early mobilisation protocols, to ensure that care is delivered efficiently. Finally, there were large differences between units in the adjusted odds of mortality, with three units reporting significantly lower estimated probabilities of death (0-0.5%) than the two units with the highest estimates (2.4% and 3.2%).³⁸

The differing delivery of care was also noted in a 2010 roundtable forum on burns prevention:

The treatment offered at burns units may differ across Australia, but there is no systematic evaluation or research of which treatment is offering the best long-term success. Even in the burns community, the surgeons themselves are doing fantastic work but they do not know whether they are doing the right work. If you go to each state they are doing it slightly differently, using different forms of treatment. This is a terrible injury, with terrible outcomes, and we do not have any systematic way of knowing whether we are offering the best treatment around Australia.³¹

In response to the above findings, ANZBA launched the Burns Quality Improvement Project in 2013. This project will use data generated by BRANZ to develop evidence-based standards of care and to provide a framework that drives change.

Australia's burn care system has been described as 'fragmented'

Because of the complex nature of burn injuries, burn patients will move through several areas of a hospital throughout their stay. Summarising a typical hospital stay of a burns patient, a burn care professional stated that a patient "might be in emergency department for a few hours. They might go to theatre for a few hours. They'll go to intensive care for a stay. They'll come to the ward and they'll be there for a while and then they might progress onto a [Metropolitan Rehabilitation Centre]".¹⁸ Whilst some burn transfers are necessary, In Australia the burn patient's trajectory is likely to be particularly disruptive, as Australia's burn units do not typically have their own critical care beds or surgery theatre, unlike those in the United Kingdom or the United States.^{24,39} Burn researchers have noted that Australia's disjointed horizontal trajectory has the capacity to result in poorly coordinated care.¹⁸

Burn care professionals have also stated there is a lack of guidelines to facilitate those with limited

knowledge and expertise to navigate the complexity of burn care. As patients move through generic wards, including ER, ICU, rehabilitation units and beyond, the associated health professionals are unlikely to have a deep understanding of burns health care. Researchers have stated specialised training must be developed to support the multidisciplinary team working in Australian burn units, and to avoid working within a siloed framework.¹⁸

Australian burn survivors have inadequate rehabilitation services

Burn survivors have injuries that can have serious physical and psychological effects on their own lives and those of their families for many years to come. Whilst the disfigurements can be lifelong, they can be ameliorated by high quality rehabilitation.⁴⁰ Unfortunately, Australian burns survivors have stated that they feel they have little support after leaving hospital.³¹ Moreover, Australian burns professionals have noted that there does not seem to be a systematic approach to support survivors after they have left hospital with a severe burn injury.¹⁸

An example comes from Mr Wayne Griffith, a burns survivor from the 2005 Eyre Peninsula bushfires, whose story was discussed in the 2010 roundtable forum on burns prevention. Mr Wayne Griffiths commented that "he felt secure while in the hospital, but then had to go home to nothing — because he had lost his wife in the fires. He added that it would have been useful to have access to a trauma psychiatrist while he was still recovering in hospital in order to enable him to build a relationship with the psychiatrist. Instead it took him three years, from when he was injured to seek the help of a psychiatrist, and that was only as a result of intervention by his family."³¹

In the same roundtable, Professor Maitz — the chair for Burn Injury and Reconstructive Surgery Surgery, Concord Clinical School — stressed the importance of post-hospital care. He stated that it is "relatively simple to repair the immediate damage to patients, but far more difficult to ensure that they receive the ongoing support they need in order to fully re-integrate into society, and enable them to have a normal life."³¹





BURN CARE IN VICTORIA

Victoria’s Adult Burns Service is located at The Alfred Hospital

Each year, at least 5000 Victorians present to Emergency Departments across the state with a burn injury.¹⁵ Victoria’s burns response is led by the Victorian Adult Burns Service (VABS) located at the Alfred Hospital. VABS treats over 300 individuals with burn injuries as inpatients and over 1000 as outpatients annually. Research has established that there is an almost complete referral of severe burns cases to VABS for definitive management, which indicates Victoria’s referral system is working as intended.⁴¹ VABS’s responsibilities include:

- Acute care for all severely injured adult burns patients in Victoria;
- Secondary reconstructive surgery for burns patients in association with the Plastic and Reconstructive Surgery Unit;
- Post-Operative rehabilitation;
- Scar management services, advice, assessment;
- Treatment of outpatients with minor burns.

VABS’s Skin Bioengineering Laboratory also conducts research in collaboration with Monash University. The laboratory has produced over 15 publications in the last five years.

TABLE 3
AVERAGE N OF VICTORIAN BURN INJURIES AND DEATHS
PER YEAR, BY GENDER, THROUGHOUT 2008-17

	ED PRESENTATIONS	HOSPITAL ADMISSIONS	DEATHS
Male	2608.5	732.5	27.9
Female	2256.2	450.8	16.2

Contradicting international guidelines, Victoria’s Adult Burns Service does not use stand-alone closed burn facilities

International guidelines advise burn units to have stand-alone facilities to prevent the transmission of infection and ensure coordinated care.⁴² The Victorian Adult Burns Service is currently housed in the ‘Main Ward Block Level 6’ of The Alfred Hospital, which is home to many other surgical subspecialties.⁴³ The burns service does not have its own operating theatre or ICU capable beds, and it largely utilises generic nursing staff and facilities. Burns rehabilitation is outsourced to Caulfield hospital, increasing the fragmented nature of burn care.

Victoria has the second largest number of deaths, and the third largest number of burn injury hospitalisation in Australia

Throughout 2016-17, NSW and Victoria accounted for the largest number of burn injury hospitalisations and deaths. Out of the 6,052 burn-related hospitalisations, Victoria was responsible for 1,113 (18%), and of the 101 burn deaths, 20 (20%) were in Victoria.⁴⁴ The rates of death and hospitalisation due to burn injuries are consistent with national rates when our population share is taken into account.

FIGURE 10 UNINTENTIONAL THERMAL INJURY DEATHS, BY STATE/TERRITORY OF USUAL RESIDENCE, 2016-17

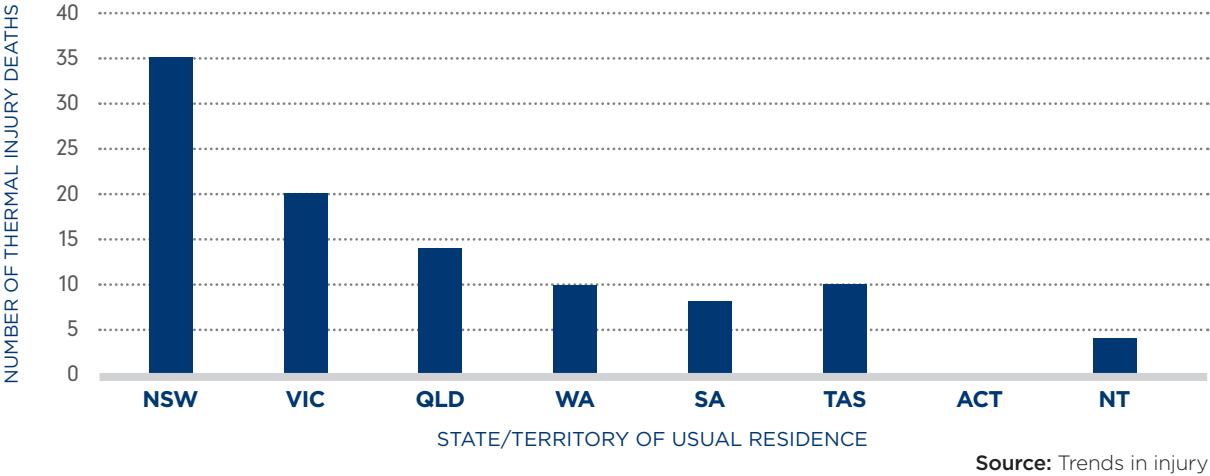
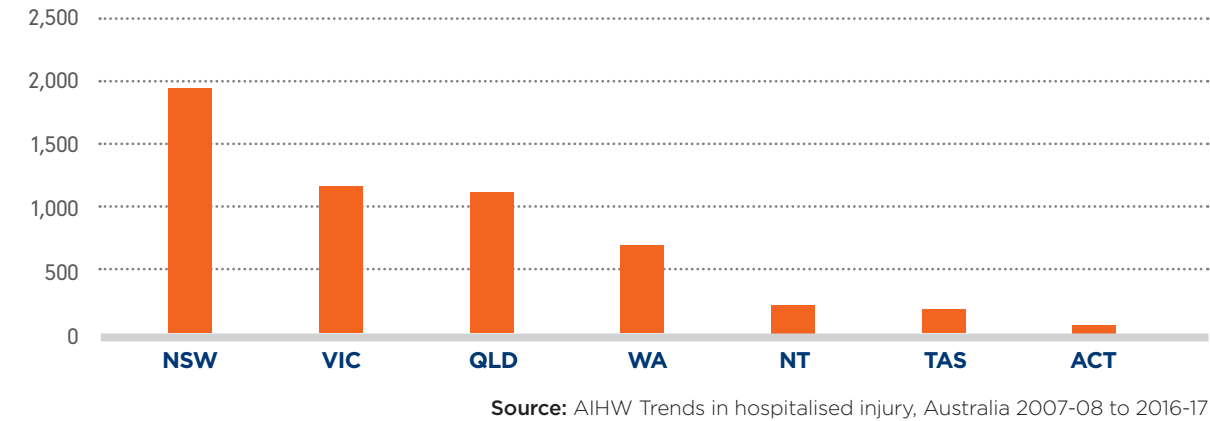


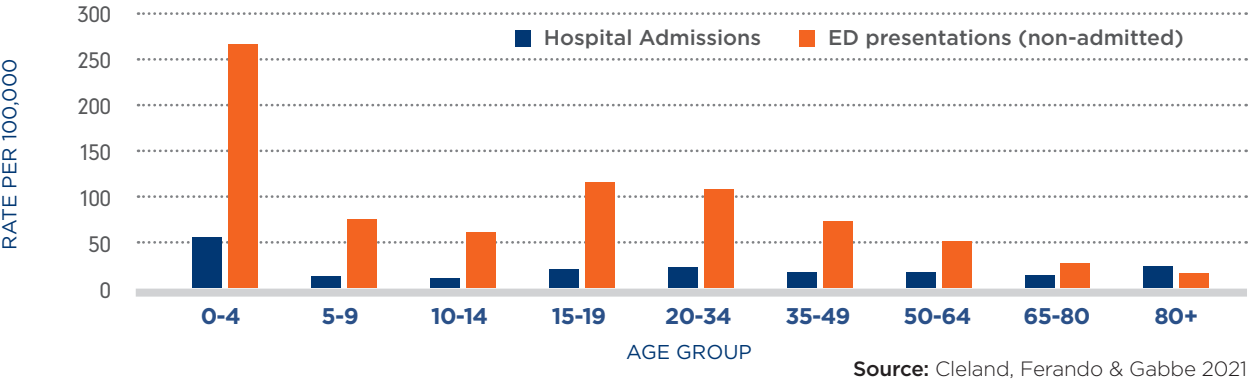
FIGURE 11 HOSPITALISED THERMAL INJURY CASES, BY STATE, 2016-17



The demographic profile of burn patients in Victoria is similar to the rest of Australia

In line with national statistics, Victorian burn patients aged 0-4 are most likely to present to emergency and most likely to be hospitalised on a per capita basis. Whilst older adults (85+) only contributed 4.9% of burn admissions, they made up 19.1% of deaths. In general, older adults in Victoria tend to experience prolonged stays and poor outcomes. Similar to national trends, men are also more likely to present at an Emergency Department, be admitted to hospital, and die from a burn injury in Victoria, when compared to women, as shown in Table 3.¹⁵

FIGURE 12 RATE (PER 100,000) OF NON-FATAL BURN INJURIES BY AGE & ADMISSION, AUSTRALIA, 2008-2017

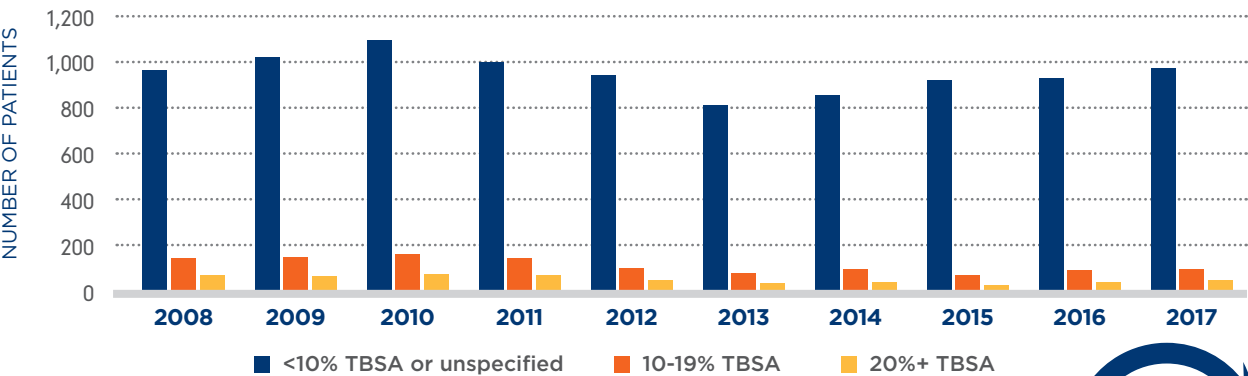


Rates of burn injuries and deaths in Victoria have largely remained unchanged since 2008

Temporal analyses demonstrate that population-based death rates from burns remained unchanged between 2008-2017 in Victoria. There was a large spike in deaths in 2009 due to the Black Saturday Bushfires. However, death rates remained unchanged when this year was excluded or included in the analyses. There was a slight decrease (2%) in population-based hospital admission rates for burn injuries throughout this period, which was more prominent for those with less severe burn (i.e., a lower TBSA). There was also a slight decrease of 1% in burn-related emergency department presentation rates over the 10-year period.¹⁵

Despite these promising signs of decreasing incidence, if current trends continue, and with continued population growth in Victoria, it is likely that numbers of hospitalised burn injuries and deaths will increase, especially for burns at the more severe end of the spectrum.¹⁵ In addition to increased demand based on population growth, life expectancy is increasing. Australians 65 years of age and over are projected to number 8.4 million and comprise 21% of the population by 2054.⁴⁵ The elderly, who are at increased risk of injury, prolonged hospital stay and death, will increasingly provide clinical challenges for the Victorian burns service.

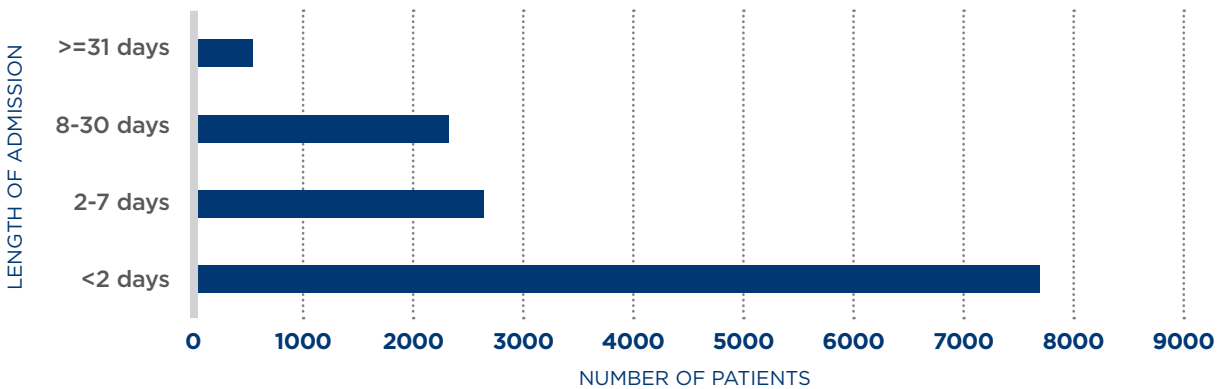
FIGURE 13 DISTRIBUTION OF SIZE OF BURN (TBSA) AMONGST BURN PATIENTS BY YEAR OF ADMISSIONS, VICTORIA, 2008-2017



Victoria’s average burn-injury hospital length of stay is longer than the national average

Most burns patients in Victoria have a hospital stay of under two days. However, the average length of stay for all burn patients from 2008-17 was 6.22 days, which is much longer than the national average: 4.9 days.^{3,15} However, these statistics are not matched for burn size or depth. Consequently, Victoria’s longer length of stay could be due to more severe and complex burn injuries among VABS patients, due to the Black Saturday bushfires and other events.

FIGURE 14 BURN INJURY HOSPITAL ADMISSIONS, BY LENGTH OF STAY IN VICTORIA, 2008-2017

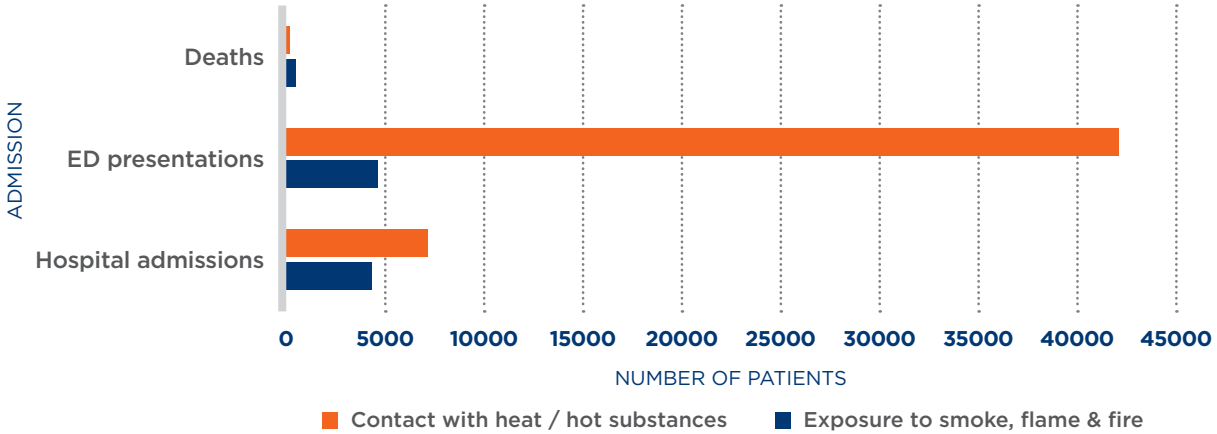


Source: Cleland, Ferando & Gabbe 2021

Most Victorian burn hospitalisations are caused by contact with heat and hot substances, whilst most deaths are caused by exposure to smoke, flame and fire

Between 2008-17, there were 11,833 burns-related admissions to hospital. A majority (52.5%) of these were caused by contact with heat and hot substances, rather than exposure to smoke, flame and fire (see Figure 15). During this period, 441 people in Victoria died of burns related deaths. Most (96.6%) deaths were due to exposure to smoke, flame and fire. This number is influenced by the Black Saturday bushfires in 2009, which accounted for 173 fire related deaths.¹⁵

FIGURE 15 BURN INJURY HOSPITAL ADMISSIONS, ED PRESENTATIONS AND DEATHS BY CAUSE IN VICTORIA, 2008-2017



Source: Cleland, Ferando & Gabbe 2021

Victoria’s Adult Burn Service is an essential part of Victoria’s mass casualty burns plan

As Victoria’s Adult Burns Service is the state’s dedicated burns facility, the service will be at the forefront of the emergency response in the event of a burns-related disaster. The 2009 Black Saturday event represented an opportunity to examine the efficacy of the state’s medical disaster response. At 8pm on the 7th of February, The Alfred was mobilised to accept major burns patients. Presentations of patients with severe burns were relatively few (n = 24) when compared with the massive number who died in the fires (n = 173). However, even with this small number, the possibility of specialist burns and intensive care units reaching capacity was high, as the patients required substantial

surgical resources during the first 72 hours, see Table 4.⁴⁶ Overall, because of the well-coordinated response and low numbers of patients with severe burns, the acute health care system was not overloaded. However, the Australian Bureau of Meteorology has predicted warmer conditions in Australia’s south-eastern states in the future.⁴⁷ This makes it likely that the conditions that led up to the Victorian bushfires will be repeated. Should fires occur and advance into more built-up areas, there may be a much higher number of deaths and severe injuries. This may require greater resources from Victoria’s burn facility, to ensure all patients can receive adequate care.⁴⁶ Best preparation for mass casualties is to have a well-resourced sustainable unit with trained experienced staff, and a proper triage and response system at the state level.

TABLE 4 THEATRE TIMES REQUIRED FOR SURGICAL PROCEDURES ON BURNS PATIENTS AT THE ALFRED HOSPITAL THROUGHOUT THE BLACK SATURDAY EVENT

	NUMBER OF PATIENTS	THEATRE TIME, IN MINUTES (HOURS)	TIME PER PATIENT, IN MINUTES (SD)
First 24 hours	9	723 (12.1)	80.3 (39.9)
Second 24 hours	6	1140 (19.0)	190.0 (74.1)
Third 24 hours	4	1058 (17.6)	264.5 (99.6)
TOTAL	19	2921 (48.7)	153.7 (98.7)



EXISTING GUIDELINES FOR BURN CARE

A burn is one of the most serious forms of any injury. A severe burn induces a cascade of inflammatory, hypermetabolic, immune, and infectious responses which are extremely complicated to treat. To ensure burn injuries are managed appropriately, burn associations and professionals have made several guidelines about the structure, facilities, and staff required within burn facilities.^{40,42}

Due to the specialised nature of burn injuries and their hyper-vulnerability to infection, the British National Burn Care Review (2000) and American Burn Association (2021) stipulate that **burns treatment should be provided in stand-alone closed burn facilities**, as opposed to multiple-aetiology general facilities.^{25,48} As early as 1942, a US surgeon treating severely burned patients noted that “the importance of concentrating casualties in one ward or floor where they can be under concentrated medical treatment and where isolation procedures can be set up if needed, was clearly demonstrated”.⁴⁹ Closed units are beneficial for several reasons. First, they provide a contained perimeter that minimises unnecessary traffic of care providers and visitors —a known cause of bacterial infection.⁴² Second, closed burn facilities create a strong sense of ‘team’ among burn staff and patients, enhancing efficiency and morale.⁵⁰ Third, stand-alone burn units allow for purpose-built burn facilities, which can further help to reduce infection and prevent mortality. Clinical research supports claims about the benefits of closed burn facilities. A Canadian study found that burn patients who received care in specialised burn centres experienced fewer emergency department visits, fewer hospital readmissions, and a lower need for subsequent unplanned acute care.¹ Other research has shown that stand-alone burn facilities are associated with reduced infection rates in patients.⁵¹

Single-bed, isolated rooms are recommended for burn victims, as common treatment areas pose risks for cross-contamination. Research on burn patients and other vulnerable patient groups provide strong evidence that single rooms substantially reduce the incidence of infection and mortality.^{52,53,54} It is now understood that common areas and shared equipment are a major source of infection spread.^{40,42} British and North American burn centres are required to provide single-bedded thermally controlled cubicles to burn injured patients.^{24,39}



The **ideal ventilation system** for a burn unit has been discussed extensively. Ventilation systems can reduce the chance of infection as they displace air exposed to pollutants. Patients with severe burns are immunocompromised and may be heavily colonised by pathogens on their open wounds. This means they are both the primary reservoir and recipient of hospital-acquired infections. Therefore, traditional hospital ventilation systems, such as positive or negative pressure rooms, are not suitable for safe management of burns patients.^{50,55} Several other suggestions have been made:

- Most authors agree that the use of high-efficiency particulate air (HEPA) filters are of benefit, provided they are regularly maintained.⁴²
- Doors and room airlocks have also been proposed, with unidirectional (laminar) flow of sterile air to reduce the airborne transmission of bacteria.⁵⁶
- Researchers have also suggested creating pressure-protected anterooms between the unit common areas and patient care rooms, to protect patients from acting as the source and end-target of airborne spread.⁵⁷

Appropriate ventilation is especially important in operating theatres, as the shared nature of the space makes it particularly conducive to airborne infection. Currently, it is recommended that operating theatres utilise laminar flow to improve circulation and reduce postoperative infections.⁵⁸

Burns researchers recommend the use of **fractional ablative CO2 lasers** to treat burn scars. Up to 70% of patients develop thick, raised (hypertrophic) scars following burns.⁵⁹ These scars continue to present a considerable challenge in burn care; they can often be resistant to conventional scar management procedures, have poor aesthetic outcomes, and often lead to considerable challenges in terms of mental health and quality of life.⁶⁰ Thankfully, the incorporation of laser and light therapy into scar management has increased the clinician's ability to reduce hypertrophic scarring.⁶¹ Indeed, a recent meta-analysis found that a 29% improvement in

scarring across 282 patients following fractional CO2 ablative laser treatment.⁶⁰ As such, non-ablative or ablative fractional lasers have become a standard therapy in many burn centres.⁵⁹

Treating a burn injury requires an enormous amount of knowledge about wound dressing, specialised intensive care, multistage surgery, and rehabilitation. Therefore, **burn injuries should be treated by expert multidisciplinary teams that specialise in burns care.**^{26,40,62}

The International Society for Burn Injuries state that “the single most important factor in the development and operation of a burns centre is the organisation of a highly trained, dedicated, tireless team that has a devoted affection for burned patients”.⁶³ The specialists required in a burn team include surgeons, nurses, anaesthesiologists, dietitians, psychosocial experts, and respiratory, occupational, and physical therapists. To ensure these professionals collaborate effectively, all team-members should be familiar with the complex nature of burn injuries, and share the common goal of delivering holistic burns treatment. The British Burns Association recommends that in a burn facility, 75% of staff should be involved in, or have completed, a course of study in burns related care that has been validated by a university.⁴⁸ It is also recommended that all professionals are primarily located at the dedicated burn unit. Research suggests that integral examinations and procedures are completed in a shorter time and at lower costs when all specialists are in the same unit.⁶⁴

Research has specifically highlighted the need for **dedicated nursing staff** that have undergone accredited training, and are therefore able to appropriately monitor, assist, and provide interventions to burn patients. Nurses are the primary surveillance system for burn patients; they perform the observations and assessments that prevent unnecessary complications such as wound infections. Demonstrating the importance of burn nurses, research has found that infection rates are greater in burn facilities when temporary nursing staff are utilised, or when centres have greater nurse workloads.^{65,66} A recent US study found that in hospitals with a high number of

burn patients, each additional patient added to a nurse's workload is associated with 30% higher odds of patient mortality.⁶⁷ Given their pivotal role in burn care, burn nurses should receive specialised and accredited training, and should be staffed appropriately.⁶⁸ Heeding this advice, The Australian Roundtable Forum on Burns Prevention recommended the implementation of a burn care nurse training and accreditation program in 2010.³¹ This recommendation prompted the development of a Burns Nursing Masters at The University of Adelaide. However, this course is no longer running, and no other burn-specific nurse training is currently available in Australia.

There is evidence that **burn-specific ICU beds** are associated with better patient outcomes. Specialised critical care units benefit from a multidisciplinary approach, where tightly knit burn teams of providers are present on the same site to provide critical care as a team. Research has found that admissions to a specialised burn critical care service is associated with a significant survival benefit for patients.⁶⁹ Other research demonstrates that the use of burns-specific ICU beds is associated with fewer positive bacterial cultures. Although, the same study found that general ICU's had a lower rate of multidrug-resistant organisms.⁷⁰ The British Burns Association recommends that adult burn patients should receive acute care in a specialised burns critical care unit where possible.⁴⁸ Similarly, the American Burns Association recommends burn centres have at least four ICU-capable beds.²⁵ However, there is ongoing debate about the benefits of establishing specialised critical care services for specific patient populations. Research suggests that the survival benefit conferred by a specialised burn critical care service may be explained, at least in part, by the care provided by a fully integrated multidisciplinary team.⁶⁹ This suggests that in the absence of a specialised ICU unit, intensivists and burns staff should interact routinely, and the designated burn ICU beds in the general ICU should be located next to the burns unit.

International guidelines recommend **integrating**

outpatient care with burn centres, to smooth the transition after hospital discharge for patients with complex burns, and ensure those with minor burns receive optimal care.²⁸ Research suggests that fully integrating outpatient care within burn centres reduces length of hospital stay, improves the inpatient centre capacity, reduces costs, and ensures continuity of care from hospital bed to rehabilitation.⁷¹ Integrated outpatient care also ensures a high standard of adherence to infection control policies within outpatient facilities, as patients are managed by burn-experienced staff.⁷² International guidelines also recommend that burn centres establish multidisciplinary burn care outreach programs to support providers of outpatient care who work in isolated areas. It's recommended that these burn programs educate professionals on wound care, scar management, functional activities and psychosocial consultation.²⁸

Similarly, international guidelines advocate for **integrating specialised rehabilitation within burn centres**.²⁸ The goal of burn rehabilitation is to assist patients to achieve their maximum physical functioning, teach them to adapt where functional loss is permanent, and to help patients return to their life roles and skills. As patients are surviving more severe burn injuries than ever before, adequate rehabilitation is essential.⁷³ Establishing specialised rehabilitation within burn centres has several benefits for patients. Integrated rehabilitation allows for the immediate initiation of intensive rehabilitation, creates greater continuity of care, and ensures that rehabilitation staff have burn-specific knowledge. Prior research has found that the transition from a burns facility to a rehabilitation hospital is a source of stress for patients and has led to negative experiences and unnecessary readmissions to burn centres.⁷⁴ Moreover, studies have shown that integrated specialised rehabilitation is associated with a reduction in patients' length of stay, a more rapid recovery of function, and improved resource utilization.^{73,75} The European, American, and British Burn Associations all recommend that burn centres have specialised and equipped spaces for rehabilitation.



As seen in Table 5, Victorian Adult Burn Service only complies with two of the eight guidelines summarised above. The service does not have access to stand-alone burn facilities, an ideal ventilation system, dedicated nursing staff, burn-specific ICU beds, or integrated rehabilitation. All of these factors contribute to the fragmented nature of burns treatment in Victoria, where patients are required to transfer between the emergency department, burn unit, operating theatre, general ICU, Caulfield Hospital for rehabilitation, and back to The Alfred for outpatient care.

TABLE 5
SUMMARY OF THE VICTORIAN ADULT BURN SERVICE’S COMPLIANCE WITH EXISTING GUIDELINES

EXISTING GUIDELINES	VICTORIAN ADULT BURN SERVICE (VABS)	
Stand-alone closed burn facilities	✗	VABS is currently housed in the ‘Main Ward Block Level 6’ of The Alfred Hospital. ⁴³
Single-bed, isolated rooms	✓	VABS utilises thermally controlled single bed, isolated rooms. ⁷⁶
Burn-specific ventilation system	✗	There is some capacity for some burn rooms to be warmed, but no state-of-the-art ventilation system (i.e. negative pressure anterooms).
Fractional ablative CO2 lasers	✗	Currently the Alfred has no laser (machines, staffing or capacity) for treatment of scarring.
Multidisciplinary team who specialise in burns treatment	✗	VABS’s team includes specialist surgeons, a physiotherapist, occupational therapist, psychologist, and a team leader. ⁷⁷ However, VABS is reliant on a high proportion of rotating junior staff across the team, who typically do not specialise in burns care.
Burn dedicated nursing staff	✗	VABS does not utilise a dedicated nursing staff.
Burn-specific ICU beds and intensivist staff	✗	VABS does not have dedicated ICU beds. Additionally, there is no core group of intensivists who specialise in burns treatment.
Integrated outpatient care	✓	The Alfred Hospital offers outpatient services at the Burns Wound Clinic. ⁷⁸ However, this clinic is not integrated with VABS. It is run and mostly staffed by outpatient staff according to a generic outpatient model.
Integrated specialised rehabilitation	✗	Burns rehabilitation is provided at Caulfield Hospital. ⁷⁸

BEST PRACTICE CONNECTIONS BETWEEN CLINICAL CARE & RESEARCH

Research plays an essential role in developing solutions to the clinical problems faced by burn patients.⁷⁹ Advances in burn care over the last fifty years can attest to the value of high-quality research. Throughout this time, the mortality rate among burn patients has decreased significantly due to research-led changes in resuscitation, infection control, and the early closure of the burn wound.⁸⁰

These advances demonstrate the value of having a dedicated burn unit that connects basic scientists, clinical researchers, and clinical care givers, allowing these professionals to ask questions of each other, share observations, and seek solutions to improve the welfare of their patients.

To continue to improve outcomes, researchers and clinicians must participate in collaborative projects. The relatively recent move towards collaborative clinical and research-oriented burn centres has allowed for greater interaction between caregivers and basic scientists. These centres spark innovation by connecting clinicians — who identify health care problems but may not have the time or expertise to solve the problems, with academic researchers — who may be unaware of important gaps in clinical care to which their expertise can apply. Establishing these connections, centres facilitate the application of novel techniques, products and strategies that improve patient outcomes, effectively taking research from the laboratory bench to the patient's bedside.⁸¹

The benefits of this 'bench to bedside' model is demonstrated by recent developments from VABS's Skin Bioengineering Laboratory — a collaboration between scientists and surgeons from Victoria's adult burns service. The lab has recently reported positive results from a clinical trial, which used a novel technique to grow human

skin in a lab to replace the need for skin grafts for burn patients.⁸² The lab plans to expand this research and run further clinical trials, having secured funding from the federal government's Medical Research Future Fund.

Given the benefits of the bench to bedside research model, researchers recommend that burn centres continue to establish strong collaborations between researchers and care-givers to produce innovative high-quality research.⁸² However, within VABS, the rotating list of multi-disciplinary team members and lack of research time allocation for senior clinicians does not provide adequate support for clinical research. The lab would benefit from hiring burn-specific multidisciplinary team members, as well as research support staff. The creation of a well-resourced Skin Bioengineering Laboratory that connects researchers with clinicians aligns with recommendations from the recent review from the Department of Health and Aging, which identified that the best performing health systems are those that embed research in healthcare. This review recommended the establishment of integrated centres that combine hospital networks, universities and medical research institutes.⁸³





INTERNATIONAL CASE STUDIES

The North American approach

In the mid-20th century, U.S. burn specialists recognised that patients with major burns required a dedicated, multidisciplinary approach to receive optimal care. This led to the development of a regionalised system of burn care: a small number of highly specialised burns centres whose sole purpose is to manage severe burns.^{40,84} The premise underlying the regionalised burns system is that concentrating burn care in a few specialised and comprehensive centres will improve patient outcomes, as these centres can maintain the necessary equipment and trained multidisciplinary staff to provide exceptional treatment for severe burn injuries.²⁶ Supporting this premise, research studying the development of a regionalised system of burn care in the U.S. found that mortality rates reduced significantly as the proportion of burns cases admitted to designated burns centres increased.⁸⁴ Other research has found that patients who receive acute care in a specialised burn centre experience significantly less need for unplanned acute care, fewer emergency department visits, and fewer hospital readmissions, when compared to those treated outside of a burns centre.¹ This research demonstrates the benefits of investing in specialised and comprehensive burn centres.

In the 1990s, the American Burns Association (ABA) and the American College of Surgeons developed a burn centre verification program to standardise the quality of burn care across North America. The verification program was designed to ensure that burn centres have the resources (organisational structure, qualified personnel, facilities and medical care services) to provide optimal care for burn patients. To become verified, burn centres must demonstrate competence in all aspects of patient care from the prehospital setting through post discharge rehabilitation. Specifically, centres must participate in research initiatives and disaster planning, and have trained multidisciplinary staff (the “burn team”), a specialised nursing unit, weekly patient care conferences, burn-specific ICU beds, a continuity of care program, a rehabilitation program, and an outpatient program.^{25,39} Alongside the verification program, the ABA developed criteria for referring patients to a verified burn centre, which are largely consistent with Australia’s referral criteria.⁸⁵

Currently, the U.S. has 127 self-designated burn centres, 70 of which have been verified by the American Burn Association.⁴⁰ Whilst the verification process can be expensive and time consuming, evidence suggests that verified burn centres offer higher-quality care and improved patient outcomes when compared to non-verified burn centres. A Californian study showed that verified burn centres admitted more patients per centre and treated more severely injured patients than non-verified centres, but offered similar outcomes.⁸⁶ Other research has found that children who face delays in transfers to verified burns centres have increased infection rates, length of stay, and other complications.⁸⁷

To promote North American burns research, the ABA has established the ABA Burn Research Network (ABuRN), which oversees all ABA-affiliated clinical trials, offering support for all aspects of the clinical research enterprise. With financial support from the US Department of Defence, ABuRN has successfully managed 11 studies at 43 Burn Centres over 8 years, totalling \$22M in funding.⁸⁸

The British approach

British burn care is coordinated by the British Burns Association (BBA). In 1998, the BBA instigated a review of Britain's burn care arrangements as there was growing evidence that their existing arrangements were disorganised, fragmented, and inadequate from the patients' perspective. The review was conducted with help from the Department of Health and the final report was released in 2001.⁴⁸

Similar to current complaints about Australian burn care, the review noted that the quality of care between burn units was enormously variable, and that many burn units had inappropriate staffing levels or infrastructure, inadequate rehabilitation facilities, and lacked continuity of care. Based on this analysis, the UK developed a new stratified structure of burn care services, similar to the regionalised care delivered by the United States. In the new structure, a small number of burn centres deliver burn services to

those most severely injured. These centres are complemented by burn units and burn facilities, which deliver care to less complex burn injuries. The review noted that centralising complex burn injuries into numerically fewer hospitals raised the potential for longer transfers. However, the review aimed to minimise this issue by locating burn centres near 'at risk' populations, and positioning the centres close to transport systems for easy emergency and routine access.⁴⁸

Much like the U.S. verification process, the BBA created national standards that stipulate burn centres must be comprised of isolated, stand-alone wards used solely for the care of burn injury, and must have qualified staff (burn surgeons, therapists, and dieticians, and a team of registered nurses who have completed burn-specific training), thermally controlled cubicles, a co-located ICU facility, and a specialised rehabilitation service. An assessment of a burn centre's facilities occurs every two years. When a service is not compliant with guidelines, the service must create an action plan to resolve the situation in as short a period of time as possible.^{24,48}

The BBA supports and encourages research into burn care by providing a platform for discussion and dissemination. They have agreed upon research priorities that are provided on their website and have annual scientific meetings where they present their work.⁸⁹

The European approach

Europe established the European Burns Association (EBA) in 1981 to encourage cooperation and standardised care among burn specialists throughout the continent. The EBA serves as a resource to facilitate communication and collaboration between burn care specialists, and to create guidelines and standards for burn care.⁹⁰

Resembling the US system, the EBA has established a verification process for burn centres. The evaluation process is a voluntary program designed to highlight burn centres that have adequate resources to provide optimal care

to burn patients. To be verified, a burn centre must be properly equipped for all aspects of the treatment of burn patients: they must have five ICU beds, adequate spaces for rehabilitation and occupational therapy, a readily available operation room with laminar flow, and physicians, surgeons, and nurses with a high level of expertise in burn treatment.⁵⁸

The EBA also provides grants, compiles its own academic journal, and runs educational courses about burn care.⁹⁰

The Germanic approach

In line with British and North American approaches to burn care, Germany has adopted a regionalised burn care system. They currently have 18 adult burns centres across the nation, which constitutes a similar patient-to-centre ratio to the U.S.^{91,92}

Whilst some of Germany's burn care centres have voluntarily received verification from the European Burn Association, Germany and the German-speaking part of Europe (Austria and Switzerland) have established their own burn centre requirements and referral criteria to standardise the quality of their burn care. A comparison of Germany's guidelines to those from the U.S. reveals very similar burn centre referral criteria and burn centre requirements, reflecting an adoption of the older ABA guidelines in German-speaking countries. Research suggests these guidelines are effective in maintaining standardised care, as burn centres in German-speaking countries typically fulfill relevant staffing and infrastructural guidelines.⁹² A paper investigating the adoption of modified ABA guidelines in Germany noted that "as a result of the positive experience and effective treatment of burn patients in German-speaking countries, we recommend an adoption of the ABA guidelines to those countries and societies that are in need of appropriate standards of burn care."⁹²

Aside from establishing quality control and referral criteria for burn care, the German Burns Association (DGV) promotes research and

therapy in the field of treating burn injuries. It works with other scientific societies, the German Government, medical bodies, and the German Hospital Society to conduct clinical trials and other basic scientific research.

Learnings from overseas

The international case studies illustrate that Australia's burn care has very few quality control measures when compared to other countries. In line with the U.S, the U.K, and Germany, Australia has adopted a regionalised system of care — the nation has a small number of facilities that specialise in treating patients with severe burns. However, unlike other countries, Australia has no guidelines to specify how burn units should be resourced and staffed, and no verification process to ensure burn care is being delivered by appropriate facilities.

As a result, Victoria's burn care faces structural issues that the UK reckoned with 20 years ago. Most significantly, burn care in Victoria is fragmented and disorganised; patients must move through separate wards to receive emergency treatment, burn care, surgery, intensive care, rehabilitation, and outpatient care. In many of these generic wards, patients will be treated by clinicians who do not specialise in burns. This structure is at odds with existing guidelines from the U.S., the U.K., Europe, and Germany, and causes disruptions in the burn patients' recovery process. When burns patients are cared for all over the hospital there is no focus, nor consistency, and it is difficult to recruit staff whose primary interest lies in the care of the burns patient.^{26,62} There are many avoidable handovers in a burn patient's journey within the Victorian system, and with every handover something is lost, something changed and much risked.

In the absence of national guidelines, Victoria's burn care system requires reform. Victoria's burn patients deserve to receive high-quality and coordinated care that is afforded to patients overseas.

RECOMMENDATIONS

Burns are one of the most serious of all injuries, and treatment requires specialist skills and adequate infrastructure. Unlike other countries, Australia has no guidelines or standards to ensure that burn facilities are appropriately staffed and resourced, no training certification, nor defined scope and standards of practice for clinicians. As a result, there are significant variations in clinical management and treatment outcomes between units in Australian and New Zealand.³⁸ Moreover, bloodstream infections appear to be increasing, and the mortality rate amongst severely burned patients remains high at 17%.^{10,41}

This report aimed to examine the current model of burn care in Victoria and compare this model to contemporary principles of best practice and leading case studies internationally. Our research uncovered that Victoria's burns service contradicts international standards in a variety of ways, and differs from other countries in the Global North, which typically have stand-alone burn centres that offer comprehensive, specialist care from admission to rehab.

An exploration of international guidelines and case studies highlights the need for a more comprehensive approach to burn care in Victoria.

RECOMMENDATION 1

The Victorian Government should fund a business case for the construction of a purpose-built, specialised Burn Centre in Victoria, with stand-alone closed burn facilities.

Contrary to international guidelines and recommendations, Victoria's Adult Burns Service is housed in a general ward, as opposed to a stand-alone close burn facility. This structure contributes to two major issues facing Australian burn patients: infection and fragmentation.

Infections are the primary cause of death for burn patients, and statistics suggest infections are on the rise within Australian burn units. Stand-alone burn facilities can help ameliorate this problem, as closed burn facilities lower infection rates by reducing shared spaces and foot traffic near immunocompromised burn patients.

Additionally, a closed burn centre would reduce fragmentation in Victoria's burn care. Currently, burn patients in Victoria are cared for all over the Alfred Hospital; they move between the emergency department, the intensive care unit,

operating theatre, burns ward, and rehabilitation facility. A purpose-made burns facility that offers comprehensive care to patients will reduce the number of handovers, improve continuity of care, and ensure that patients are seen by specialist clinicians who understand the complex nature of burn care.

To provide adequate care to Victorian burn patients, a purpose-built stand-alone closed Burn Centre is essential. As a first step, we recommend the Victorian Government fund a business case to examine the relative benefits and costs of this construction. The business case should investigate the most appropriate location for the Burn Centre. Attaching the Burns Centre to The Alfred Hospital may be beneficial as the Alfred Hospital houses Victoria's major trauma service, and burns occasionally coincide with other trauma injuries. However, locating the centre at an alternative tertiary hospital could have other advantages. For example, locating the centre at Monash Medical Centre could provide greater space for a larger burn centre and better support for clinical trials, as the centre houses the Hudson Institute of Medical Research — a purpose-built research space designed to foster innovation and health translation. Moreover, Monash Medical Centre's collocation with Monash Children's Hospital could give rise to a shared adult and paediatric burn unit. This supports the vision of a centre of excellence that treats burns for all Victorians across the ages, with integrated research facilities and close proximity to Monash University campus at Clayton.

Current research shows that quality-of-life following burn incidents is significantly influenced by the primary treatment and will often remain suboptimal.⁹³ Further physical disabilities, poor mental health and social isolation are currently too often the chronic outcomes of extensive burn injury.⁵⁹ The development of a stand-alone burn center can promise high-quality burns

assessment, treatment and care, which will improve patient outcomes, reduce infection rates, and alleviate the burden of poor-quality treatment on the healthcare system.

RECOMMENDATION 2

The Burn Centre should have facilities and staff that accord with recommendations from the existing academic literature, the European Burns Association, the American Burns Association, and the British Burns Association.

The required facilities and personnel should include:

- Specialised staff that have appropriate burns-related training, including a dedicated nurse unit;
- Close access to isolated, climatized, acute burn care beds, which allow proper patient surveillance and intensive care monitoring;
- An operating room with at least 42 m², with laminar flow and a wide range of temperature settings specifically designed for burns;
- Thermally controlled single-bedded cubicles;
- A burn-specific ventilation system;
- Technology and staff to treat scarring with fractional ablative CO₂ lasers.

There is a wealth of knowledge about the best infrastructure and staffing arrangements to provide high-quality burn care. Thankfully, this information has already been summarised by many national burn associations and used to create standards and guidelines. Victoria should utilise this knowledge to build a world-class burn centre that can adequately treat those with severe burns.

RECOMMENDATION 3.

Outpatient care and rehabilitation services should be fully integrated with the Burn Centre.

As the goal of burn care shifts from patient survival as an end state to a state of restored living, focused rehabilitation and outpatient care becomes a critical component of burn care. To ensure these services provide high-quality care, they must be incorporated into the Burns Centre and delivered by burns specialists. Our research uncovered that both outpatient and rehabilitation services are greatly improved when incorporated into existing burn facilities.

As part of the outpatient care program, the Burn Centre should establish multidisciplinary burn care outreach programs, to support providers where travel is difficult in their region. This would include training and education for providers of burn care in Victoria.

The adoption of this recommendation aligns with current guidelines developed by The International Society For Burn Injuries, and would ensure that Victorian burn patients receive seamless and integrated burns care.

RECOMMENDATION 4.

The Burn Centre should build on VABS's existing relationship with Monash University to conduct bench-to bedside research and educate the next generation of burns providers, as well as the community at large.

Recent successful clinical trials by VABS and Monash University demonstrate the power of clinical and academic collaborations. A comprehensive Burn Centre could capitalise on these existing collaborations with Monash University, and expand the scope of future research projects to further enhance the treatment and prospects of patients with severe burns.

Victoria's 2016-2020 Health and Medical Research Strategy noted that Victoria maintains excellence in health and medical research, education and training, and a vibrant biotechnology sector. To further promote innovation, the Victorian Government specifically highlighted the importance of integrating research, education and healthcare.⁹⁴ To this end, the Victorian Government has encouraged integration between universities, health services, medical research institutes and industry. Given VABS's track record of high-quality research and healthy academic collaborations, the newly created Burn Center could help Victoria achieve its aim of becoming a leader in biomedical engineering research, by establishing a world-class hub for burns research and education. A strong collaboration would lead to improvements in patient care and biomedical engineering tools, and subsequently, health outcomes for Victorians who face severe burns.



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