BURNS 50 (2024) 1355–1371

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/burns

The impact of burn injuries on indigenous populations: A literature review

Leah Verburg *, *Vincent Gabriel*, *Graham McCaffrey*

Faculty of Nursing, University of Calgary, Canada

ARTICLE INFO

Article history:
Accepted 26 February 2024

Keywords:
Indigenous
Aboriginal
Burns

ABSTRACT

Introduction: Ethnic minorities experience disparities in prevention and treatment of burn injury. Research focused on burn injuries in Indigenous populations is limited. This review summarizes literature on burn injuries in Indigenous populations to be considered to inform new research.

Methods: A search was conducted in CINAHL, Ovid MEDLINE, PSYCinfo and SocINDEX. for "burn OR scars OR scald OR deformity OR disfigurement" and "Aboriginal OR Indigenous OR First Nation OR American Indian OR Maori OR Native OR Torres Strait Islander OR Amerindian OR Inuit OR Metis OR Pacific Islander". Inclusion 1) peer reviewed studies of burns in Indigenous persons 2) in English. Exclusion 1) no data specific to Indigenous burns 2) not peer reviewed 3) not in full text 4) protocol publications.

Results: The search identified 1091 studies with 51 for review. Sixteen were excluded. The 35 included publications were published between 1987 and 2022. Findings indicated higher incidence of injury and poorer outcomes amongst Indigenous people. Indigenous people suffered more flame and inhalation burns, had longer lengths of stay, and more complications including hypertrophic scarring. Australian Indigenous patients struggle with a lack of culturally safe communication and support for aftercare.

Conclusion: Racial disparities exist in burn injury incidence and outcome for Indigenous persons. Qualitative research in this area will help providers better understand the experiences of Indigenous burn patients to develop more culturally competent care. We are currently developing a study using qualitative hermeneutic methodology to learn about the experiences of Indigenous burn survivors' injuries, recovery, and social reintegration.

Contents

* Correspondence to: Faculty of Nursing, University of Calgary, 2500 University Drive NW, Calgary, Alberta T2N 1N4, Canada.
E-mail address: ljverbur@ucalgary.ca (L. Verburg).

https://doi.org/10.1016/j.burns.2024.02.023
0305-4179/

1. Introduction

Burn injuries involve specialized care to limit long-term sequalae and obtain the best possible outcomes. Indigenous people in Canada experience health disparities in many areas, including barriers in accessing specialized care [1]. How these health inequities influence outcomes in burn care is not fully understood. The purpose of this review was to determine what is currently known about burn injuries in Indigenous populations including characteristics, impact of injuries, and opportunities to improve outcomes. It describes epidemiological data available and connects that data to the context of cultural factors and health inequities experienced by Indigenous people. It identifies trends and commonalities in research findings, and gaps in current literature. This review was completed in preparation for a study of care experiences and social reintegration with Indigenous burn survivors in southern Alberta, Canada.

2. Background

Non-fatal burns cause disfigurement and disability that are associated with stigma and social rejection [2]. Advances in burn treatment in high-income countries have decreased burn mortality rates significantly [2,3]. Data from the American Burn Association shows [4] survival after burn injury was reported as over 96.5% between 2015 and 2019. As a result, people in high-income countries are living with the impacts of more severe burn injuries than ever before.

National Burn Repository (NBR) data, which includes data from the United States (US), Canada, and Australia, reports burn injury risk is highest in males aged 20–29 and 50–59 [4]. Between 2015–2019, females in the US had a higher risk of mortality compared to males, 3.5% compared to 3.0% [4]. Globally, females are at a higher risk of burn injury death, which contrasts with other traumatic injury mechanisms that are higher in males than females [2]. The increased risk in females is globally associated with open-fire cooking, unsafe cook stoves, as well as self-directed and interpersonal violence [2].

According to data from WHO [2], lower socioeconomic status is associated with an increased risk for a burn injury in all countries. People living in low- and middle-income countries have higher risk for burn injury overall. This risk is related to poverty, lack of proper safety measures, and overcrowding. Lower socioeconomic status and younger people being placed in household roles such as cooking or caring for younger children in the family also contributes to increased risk.

Race is also associated with more burn injuries and worse outcomes [5]. Canadian census data from 2011 demonstrated Indigenous people had a fire-related mortality rate of up to 5.3 deaths per 100,000 people, compared to a rate of 0.3 per 100,000 people in the non-Indigenous population. The burn specific mortality rate among Indigenous people was 1.0 per 100,000 compared to 0.2 in non-Indigenous Canadians. Hospitalisations for burn injuries occurred at a rate of 4.3 hospitalisations per 100,000 person-years in the non-Indigenous population, and up to 13.9 per 100,000 in the Indigenous population[6]. Indigenous populations across Canada, the United States (US), Australia, and New Zealand have higher incidence of burn injury, however patient outcomes research for burn injuries in Indigenous populations remains limited. Most of the research available are retrospective database reviews with limited details around circumstance of injury or long-term outcomes for survivors.

Statistics Canada [7] defines *Indigenous identity* as those people who identify with the Indigenous peoples of Canada. In Canada, that includes those who identify as First Nations, Inuit, and Métis. Under the *Indian Act*, Indigenous people must apply for 'Indian status' to receive government supports promised to Indigenous people in Canada. This involves providing proof with legal documentation that an

immediate family member (parent or grandparents) is Indigenous[8].

Systemic racism toward Indigenous peoples and the disparities between the health of Indigenous and non-Indigenous people is well documented in Canada [9]. Colonialism leading to systemic racism and intergenerational trauma is known to significantly impact the health of Indigenous peoples [10]. In addition, Indigenous people tend to hold health perspectives which may not align with the goals of modern healthcare outcomes, and therefore their needs are not met by the current system [11,12]. Although general health inequities are known, the impact of this is unknown. Furthermore, since burn injury risk is shown to be related to socio-economic status, we can draw parallel to an increased risk among the Indigenous population that has been marginalized by colonialism.

Burn wounds are graded into four categories of increasing severity: superficial, superficial partial-thickness, deep-partial thickness, and full-thickness [13]. With adequate wound hygiene, superficial and superficial partial-thickness injuries can heal without surgical treatment and result in minimal scarring. Deep-partial thickness injuries can heal without surgical intervention but may result in significant scarring without surgery. Full-thickness injuries typically receive surgical intervention to heal for best functional outcome. The standard treatment for deep-partial and full-thickness burn wounds is early wound debridement and autologous split-thickness skin grafting [14]. Even though autologous grafting may achieve wound closure with less significant scarring compared to leaving the wound to heal on its own, it still results in permanently dysfunctional, scarred, pruritic skin [13,15].

Burn survivors report having to adjust to a "new normal" in lifelong physical and psychological recovery [13,15]. The incidence of hypertrophic scarring, which is thickened extracellular dermal matrix development, has been reported to have prevalence as high as 70% in burn survivors [16]. Hypertrophic scarring is associated with pruritus, pain, and mobility impairments when joints are affected. This fibrotic scarring affects appearance which can lead to psychological challenges for survivors [17]. Burn survivors experience emotional distress, anxiety, and difficulties with body image related to hypertrophic scarring [18]. Survivors also report feelings of guilt, shame, and blame around the etiology of their injuries which contributes to development of psychological conditions after injury that may not correlate with severity of injury [19]. The combination of physical and psychosocial factors can make it difficult for many survivors to return to their pre-injury social roles, and significantly impact long-term reintegration outcomes [16,20].

Upon leaving acute care, burn survivors adapt from their role as a patient back into their individual community roles. Burn survivors must adjust to changes in appearance, potential disabilities, and the psychological impacts of their injuries. Three elements of disability are described: physical impairment, limitation in activity, and participatory restrictions (such as social or work activities) [21]. Burn injuries can impact each of these areas, with potential to cause significant disability for survivors. Successful return to pre-injury roles and function is the ideal outcome of burn recovery. Burn survivors have identified community reintegration and its accompanying challenges due to injury as one of the most essential issues for survivors [22]. Long-term well-being for burn survivors is dependent on their ability to successfully reintegrate into their communities [22].

3. Method

The search for this review was completed by the first author between January and November 2022. The search strategy, databases, and search terms were decided in consultation with a Faculty of Nursing librarian and confirmed by the authors. Inclusion and exclusion criteria were decided between the first three authors. All articles were screened by the first author for eligibility, with consultation of the other authors if needed.Table 1.

3.1. *Literature search strategy*

The literature search conducted is reported in Fig. 1 in compliance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analysis) framework. The search was conducted in four databases: Ovid MEDLINE, PSYCinfo, SocINDEX, and CINAHL. Refer to Table 2 for detailed search methods. The search was limited to articles in the English language, with no restrictions on publication date. Search terms were selected to gather the greatest amount of data available and included terms such as “burn OR scars OR scald OR deformity OR disfigurement” and “Aboriginal OR Indigenous OR First Nations OR American Indian OR Torres Strait Islander”. The full list of search terms can be found in Table 2.

3.2. *Exclusion criteria*

Articles were excluded from the literature review if they were not available in full text. Articles were also excluded if they were editorial, letters, or made assumptions that were not backed by research or data. Articles which included data on broad accidental injuries without data specific to burns were excluded. Protocols published as articles for later research were also excluded.

3.3. *Results*

Between the four databases searched, 1091 titles and abstracts were reviewed. After title and abstract review, 51 full text articles were extracted as warranting further evaluation. Sixteen publications were excluded. Of these excluded, three were editorials or letters. Five were not full text. One was a protocol only and one did not reference Indigenous persons. Two reported accident rates in Indigenous populations but not burn specific data. Two excluded articles did not report burns data in the Indigenous population. Two were excluded as the conclusions were not supported by the data. A total of 35 articles were included in the review.

All selected articles were published by authors or institutions in Canada, the US, New Zealand, or Australia. Four studies were Canadian, nine studies were American, four were

Table 1 – Overview of Included Articles.

Author (s), year, country	Aim or purpose	Population, sample size	Design	Key findings
Bishai et al. (2010) US	To determine disparities in fire/burn deaths across ethnicities.	All unintentional fire related deaths by ethnicity, gender, and age from 1999-2004 compared to census data from the same years. Total sample size not reported.	Retrospective database analysis	Higher rate of burn/fire deaths for Indigenous Americans across the lifespan that increased further after the age of 50.
Callegari et al. (1989) Canada	To determine if the Indigenous population from the area served by University of Alberta hospital in Canada are at greater risk of severe burn than the general population, and what the differences in burn injury type are.	Patients admitted to University of Alberta Hospital from 1977 to 1986, n = 1598. Case group (Indigenous patients) = 125 Control group (non-Indigenous patients) = 1473	Retrospective case-control	7.8% of the patients admitted were Indigenous compared to 4.2 per cent of the general population in the same given area served by the center. Indigenous people: ● suffered larger total body surface area (TBSA) burns. ● were hospitalized on average 16.9 days longer. ● underwent 0.7 more operations than their non-Indigenous counterparts. ● were three times more likely to remain within the health care system as inpatients for rehabilitation after acute burn management has been completed. Mortality rates because of these burns were similar for Indigenous (4.8 per cent) and non-Indigenous (4.3 per cent). Indigenous population was at higher risk of suffering burn injury after adjusting for certain demographic variables.
Chen et al. (2018) US	To identify at-risk populations for differences in patient and social characteristics that may link certain racial groups disparate burn outcomes.	Burn patients admitted to 96 US hospitals between 2002 to 2009, *n* = 163,366.	Retrospective database analysis	0.7% of the study sample was Indigenous American. Indigenous Americans had: ● the highest proportion of public insurance. ● highest percentage of alcohol and drug abuse. the highest rate of respiratory, renal, wound, graft, and infectious complications. ● the longest length of stay (LOS). They conclude with a call for further research on contributing factors to burn injury and burn outcomes in the Indigenous American population.

(continued on next page)

Table 1 – (*continued*)

Author (s), year, country	Aim or purpose	Population, sample size	Design	Key findings
Coombes et al. (2021) Australia	To describe the perspectives on the role of First Nations Health Workers (FNHW) in care for pediatric burn patients.	Combined two study populations for a total of 19 First Nations families, 11 First Nations Health Workers and 56 multidisciplinary burn team members from across Australia, $n = 86$	Combined data from two qualitative studies	Multidisciplinary healthcare teams recognise the importance of FNHW's, but the systems are not set up to support resourcing. First Nation families experienced improvements in cultural safety and received tangible support from FNHW. Health systems excluded First Nations ways of knowing, being and doing. Active participation of FNHW is essential for service delivery and ongoing care of family.
Coombes et al. (2020) Australia	To explore the barriers and facilitators of culturally safe burn aftercare for Indigenous children in Australia.	Members of 18 families with a child affected by burn injury, $n = 59$.	Qualitative interviews using Indigenous methodologies of yarning (dialogue) and Dadirri (deep listening).	Indigenous reported: • feeling confused about what to expect when they left acute care. • that communication lacked sensitivity. • that distances from hospitals after discharge was an issue regarding stress, cost, and time. • lack of local support for aftercare • lack of written, culturally appropriate resources • concerns over family disconnection due to physical separation. • feeling judged and disempowered by colonialism they experienced in their child's burn care. • First Nations Healthcare workers as having positive impact on care and well-being.
Duke et al. (2012) Australia	Identify gender-specific burn injury mechanisms, describe trends in burn injury hospitalisations and burn injury characteristics.	All people admitted to hospital with a burn injury in Western Australia from January 1983 to December 2008 between the ages of 15-29. $n = 6404$	Epidemiological database analysis	Indigenous adolescents were over 2.3 times more likely to suffer burn. Overall decrease 53% hospitalization for Indigenous people versus 35% for non-Indigenous people. Indigenous people had longer length of stays. Indigenous females had highest rate of assault related burn injury.
Duke et al. (2011) Australia	Assess incidence, trends, and external cause of burn injury-related hospital admissions.	All people admitted to hospital with a burn injury in Western Australia from January 1983 to December 2008, $n = 23,450$.	Epidemiological database analysis	Indigenous population had hospitalization rates 3.8 (95% CI: 3.6 –3.9) times that of the non-Indigenous population. Age-standardized rates of hospital admission for burn injury of Indigenous people declined 58% overall (95% CI: 52–63) from 1983 to 2008, compared to 32% (95% CI: 29–35) decrease for the non-Indigenous population.

(*continued on next page*)

Table 1 – (*continued*)

Author (s), year, country	Aim or purpose	Population, sample size	Design	Key findings
Fraser et al. (2021) Australia	To explore how burn care is delivered in tertiary burn units and to identify what informs care provision of multidisciplinary teams when working with Aboriginal and Torres Strait Islander children and families.	Multidisciplinary individuals who provide burn care in six different pediatric burn units in Australia. $n = 76$.	Qualitative interface research	Most healthcare providers reported providing differential care but were more confused at the difference between equal and equitable. and some, mostly physicians, denied differential care and stated all was "equal".
Fraser et al. (2018) Australia	To describe Australian and international burn injury models of care to assess how they facilitate safe and high-quality burn care for Indigenous children.	Reviewed six models for burn care in Australia	Model Analysis	Found that all models of care had gaps in cultural safety for care of Indigenous people. The models lack explicit guidelines for addressing cultural safety.
Fraser et al. (2020) Australia	To investigate the factors that inform burn care for Indigenous children in Australia.	Purposive sampling of multidisciplinary burn team members across six burn units, $n = 76$.	Qualitative interface research methodology	Indigenous liaisons were under-resourced under-utilized. Stereotyping was present around Indigenous ways of being. Healthcare practitioners' way of knowing were heavily based within in positivist paradigms. Team members expressed a desire for more appropriate care for this population, but acknowledged competing demands for evidence-based quality indicators, and complicated by a system deeply entangled with colonizing ideologies. Concluded that inclusion and uptake of evidence on how to better care for Aboriginal and Torres Strait Islander children is needed.
Harre et al. (1998) New Zealand	To determine children's involvement in at home activities that carry risk for burn or scald injuries.	Children between 7-13 years old in Auckland, New Zealand, $n = 421$.	Survey	Study showed that Indigenous children in New Zealand were more likely to be involved in burn risk activities at younger ages. Also found that these children had reasonable knowledge of the risk involved with those activities.
Jenkins et al. (1996) Canada	To determine the effectiveness of a burn discharge book on burn care related knowledge improvement.	Eligible families from the Winnipeg Children's Hospital burn unit, $n = 141$.	Single blind randomized trial	Discharge teaching resource had significant effects on non-Indigenous participants, but not on Indigenous participants. Demonstrated need for culturally appropriate resources.
Hyland et al. (2015) Australia	To examine the differences in burn injuries between children residing in metropolitan and rural areas.	Children who presented to Westmead Children's Hospital between January 2008 and December 2012, $n = 3468$.	Retrospective data analysis	Indigenous children were overrepresented from both metropolitan and rural area. 11.6% of metropolitan burns and 26% of rural burns were Indigenous children, despite Indigenous people making up 2.4% of the general population.

(continued on next page)

Table 1 – (*continued*)

Author (s), year, country	Aim or purpose	Population, sample size	Design	Key findings
Jenkins et al. (1996) Canada	To determine the effectiveness of a burn discharge teaching book on burn care related knowledge improvement.	Eligible families from the Winnipeg Children's Hospital burn unit, $n = 141$.	Single blind randomized trial	Discharge teaching resource had significant effects on non-Indigenous participants, but not on Indigenous participants. Demonstrated need for culturally appropriate resources.
Kramer er al. (2010) US	To examine variations of burn injury across age, race, and payor status.	All US National Burn Repository data for patients under < 18 from 1995 to 2007, n = 46,582.	Retrospective data analysis	Indigenous burn rate was similar to the population rate. Non-Caucasian patients including Indigenous patients had significantly lower mean age at injury, had increased intentional etiology and inhalation was more common.
Mistry et al. (2010) New Zealand	To analyze and describe socioeconomic factors associated with burn injuries.	Patients admitted to hospital with burn injuries between January 1996 to December 2006, $n = 14,708$.	Retrospective data analysis	Rate of admission was highest for Indigenous ethnic groups and increased in proportion to socioeconomic deprivation. The rates of admission for Indigenous people were higher across all deprivation levels.
Moller et al. (2017) Australia	To investigate the differences in characteristics of burn injuries among Indigenous and non-Indigenous people.	Cohort of children resident and born in NSW between Jul 2000 and December 2012 ($n = 1124,717$). 323 Indigenous and 4246 non-Indigenous children were hospitalised for burn injury.	Cohort analysis	Indigenous children were more likely to have a burn > 10% of TBSA. Indigenous children had greater length of stay even when adjusting for remoteness.
Moller et al. (2019) Australia	To determine if rates of injury in Australian Aboriginal children and differences in injury rate from non-Aboriginal children have changed.	Comparison of cohort from their 2017 study with comparison of cohorts of children born between 2003 to 2007 (633 Aboriginal children) and 2008 to 2012 (955 Aboriginal children).	Cohort analysis comparison	Aboriginal children remained to have burn injury rates of 2.5 times higher than non-Aboriginal children. However, burn injury rate did decrease in rate from 2003-2007 cohort by 30%.
Murphy et al. (2019) Australia	To describe the demographics, circumstances, and burn wound characteristics of interpersonal violence burn victims.	Admissions to Royal Darwin Hospital identified as meeting interpersonal violence criteria from 2010-2015, $n = 53$	Retrospective Cohort data analysis	Indigenous women were more likely to be affected by interpersonal violence burn injuries
Oyetunji et al. (2012) US	To identify injury characteristics and ethnic profiling of injuries for children under five years old.	32,033 pediatric patients from the National Trauma Databank from 2003-2006. Index records included approximately $n = 7364$.	Retrospective data analysis	Burn injury was disproportionately higher in Indigenous American children (15.3%) compared to Caucasian children.

(continued on next page)

Table 1 – (*continued*)

Author (s), year, country	Aim or purpose	Population, sample size	Design	Key findings
Papp & Haythornthwaite (2014) Canada	To determine how ethnicity is involved in burn trauma.	Data from the Vancouver General Hospital burn centre between 1973-2009, including all ages, n = 4197.	Retrospective data analysis	Indigenous people: ● were more likely to be injured by flame (60.1%), and at home. ● were more likely to present with contributing factors (alcohol/drugs, use of accelerants, cigarettes, psychiatric conditions, and epilepsy). ● most likely to present with full-thickness burns > 5% TBSA. ● tended to present with the most severe injuries in TBSA and depth of burn. ● had highest rate of inhalation injury (18%) had the longest mean length of stay (31 days) Indigenous females were more likely to suffer injury compared to other ethnicities.
Peters et al. (2022) US	To identify at risk ethnic groups to determine which are understudied and provide recommendations to address disparities.	36 articles, n = 5 addressed burn injuries in Indigenous Americans	Systematic review	Four of the articles are reflected in this literature review including Chen et al. (2018), Kramer et al. (2010), Swann et al. (2019), and Thompson et al. (2013). One which was not reflected in this review had findings that suggested Native American children (as well as black and Asian children) were disproportionately affected by burns.
Rea & Wood (2005) Australia	To classify patient demographics and injury patterns of patients.	All patients admitted to minor burn clinic at Royal Perth Hospital in Australia between January 2004 and November 2004, *n* = 227	Prospective data analysis	Indigenous people made up 2.5% of the patients. Population rate of Indigenous people in Western Australia reported from census data (2001) to be 3.5%. Authors describe this as being related to urban bias of study where majority of the Indigenous population lives rurally.
Read et al. (2018) Australia	To determine the adequacy of burns first aid treatment.	All pediatric and adult patients who were managed by Royal Darwin Hospital burn service in 2014. *n* = 310	Prospective cohort analysis	Indigenous Australians in Northern region are 2.5 more likely to apply no burn first aid treatment compared to non-Indigenous people. Indigenous people were four times more likely to have burn first aid treatment applied by an emergency responder or healthcare provider. Indigenous people made up 19% of study cohort. Indigenous people made up 30% of studied population area, which contrasted with national data demonstrating higher rate of burn injuries amongst Indigenous people.

(continued on next page)

Table 1 – (*continued*)

Author (s), year, country	Aim or purpose	Population, sample size	Design	Key findings
Reidlinger et al. (2015) Australia, New Zealand	To investigate the incidence, causes, demographics, and treatment for scald injury with hospitalisation.	Patients under the age of 14 who were admitted to 13 BRANZ participating hospitals between 2009-2010, *n* = 730.	Retrospective data analysis	Indigenous children were more than three times as likely as non-Indigenous children to be admitted for a scald burn. Indigenous people were overrepresented relative to their national populations in Australia and New Zealand.
Ryan et al. (1992) Canada	To compare demographics, hospital course and outcomes of pediatric burns.	Children admitted to University of Alberta hospital between January 1978 and December 1988, *n* = 583.	Retrospective data analysis	Indigenous children overrepresented the non-Indigenous population by a factor of 10:1 and had more flame injuries. Indigenous children had a higher rate of hospital admission.
Ryder et al. (2021) Australia	To understand the expenses of Aboriginal families of children with burn injuries.	Families recruited from a larger study on burns in burns in Indigenous children, *n* = 6.	Qualitative interviews with thematic analysis	Families described financial strains from travel and ongoing care. They also described social losses from community and family from having their child in hospital.
Ryder et al. (2021) Australia	To examine the burns epidemiological profile and risk of infection using an equity lens and decolonising processes.	6980 children admitted to hospital in Australia for burn injury using BRANZ data, *n* = 6980.	Retrospective data analysis combined with decolonisation and knowledge interface.	Low socioeconomic status was more common in Indigenous children, and Indigenous children were more likely to reside in very remote regions. They had higher rates of hip and lower limb burns than non-Indigenous children. Indigenous children had higher rates of flame burns (19.5% compared to 10.6%). They had more full thickness burns. Higher rate of infections (4.3 times greater). Length of stay was double that of non-Indigenous children. Indigenous children were over-represented compared to their population rate, 10.8% of registry data versus 5.3% population rate.
Ryder et al. (2020) Australia	To determine factors relating to longer length of stay in burn injured Aboriginal and Torres Strait Islander children.	Burn injured children between 2009-2018 from BRANZ data. Including 723 Aboriginal and Torres Strait Islander Children and 6257 non-Aboriginal Australian, n = 6980.	Retrospective data analysis	Length of stay was 4 days longer on average for Indigenous Australian children than it was for non-Indigenous. Factors contributing to longer length of stay included rural living, lower SES, increased severity of burn (more flame burns) and complexity of treatment.
Skinner et al. (2004) New Zealand	To determine the effect of a multi-media campaign aimed at improving burns first aid treatment.	All patients treated at a regional burn center over two four-month intervals. Pre-campaign: November 1997 to March 1998, N = 121 and post-campaign November 2001-March 2002, N = 123.	Cohort comparison	Found that post-campaign burns first aid treatment occurred at a rate of 59% compared to previous 40%. Indigenous populations, Maori and Pacific Islander, had the greatest improvements from 33 to 61% and from 25 to 48.2% respectively.

(continued on next page)

Table 1 – (*continued*)

Author (s), year, country	Aim or purpose	Population, sample size	Design	Key findings
Skinner & Peat (2002) New Zealand	To determine adequacy of community burns first aid treatment and impact on outcome	Patients treated at a regional burn center from November 1997 to March 1998, n = 121.	Prospective cohort	40.5% of patients received adequate burns first aid treatment. Indigenous people were over-represented as inpatients. 33% of Maori and 25% of Pacific Islander patients received adequate burns first aid treatment compared to 50% of Caucasians.
Sood et al. (2015) US	To examine if race and MC1R single nucleotide polymorphisms are associated with risk of development of hypertrophic scarring.	Burned adults admitted to University of Washington Medicine Regional Burn Centre, n = 586, N = 9 Indigenous participants.	Prospective cohort	Burn itch and hypertrophic scarring was independently associated with Indigenous American race.
Swann et al. (2019) US	To analyze epidemiology, clinical course, and outcomes of burn injured Indigenous Americans.	Burn patients from all burn center admissions Arizona from 2000 to 2015, for a total of n = 10,521, with N = 966 Indigenous burn patients	Retrospective data analysis	Indigenous American burn patients: • had lower injury severity score on admission. • had smaller second degree burn TBSA's on average. were more likely to have ETOH on board – however also had statistically significant higher test rates (more likely to be tested). • were more likely to be transferred by air.were more likely to be from rural locations. • were more likely to be burned in recreational locations/activities. had more flame/contact burns. • more likely to be burned in winter months. • were more likely to be burned while "conducting suspected criminal activities". • were likely to have surgical procedure but had fewer procedures. had longer LOS. • were less likely to be discharged home and more likely to be transferred to another medical facility. • were more likely to have expenses paid by Medicaid versus private insurance or other sources. Authors concluded that Indigenous Americans have a different experience of the healthcare system than non-Indigenous Americans after suffering a burn.

(continued on next page)

Table 1 – (continued)

Author (s), year, country	Aim or purpose	Population, sample size	Design	Key findings
Thompson et al. (2013) US	To determine genetic variations associated with development of hypertrophic scarring.	Adult patients determined to be at risk for hypertrophic scar development, n = 300.	Prospective cohort	Indigenous American race was found to have higher risk of hypertrophic scarring. Small sample size of Indigenous Americans (N = 9) called for further studies to confirm findings.
Williams et al. (2020) Australia	To assess the effectiveness of psychosocial interventions on pediatric burn patients' pain and trauma and analyze their appropriateness for Aboriginal and Torres Strait Islander families.	17 articles	Systematic review	Despite over representation of Indigenous Australian burn victims, none of the studies addressed the effectiveness of psychosocial interventions for Indigenous populations.

from New Zealand, and eighteen were Australian. One study included both Australia and New Zealand. The most recent article included was published in 2022, and the oldest published in 1987 with the majority, 24, articles published since 2012. Most of the studies were database reviews either from nation-wide, burn specific databases or from institution specific databases. Seven of the articles included were qualitative.

Data were analyzed by reviewing each article that met inclusion criteria in full. Many studies in this review were focused on racial differences across several races; only data for burns in Indigenous populations were included. From articles with measurable data, data that reached statistical significance or were common data reported across several studies were highlighted for inclusion. Findings that highlighted differences in Indigenous burns compared to general population were also included. Categories were created to organize the data according to common or themes categories that were reported in the literature findings in chronological order from incidence to outcome. From qualitative data, findings reported in this review included themes that were presented in findings and categorized according to perspective which data was collected from.

3.4. *Incidence*

3.4.1. *Canada*

Three publications in this review reported burn injury incidence amongst Indigenous people in Canada. One study reported that Indigenous children were overrepresented compared with other populations of children at a burn centre serving Northern Alberta and Northwest Territories [23]. In the area served by the burn centre, the population rate of Indigenous peoples was 1.4% at that time, yet Indigenous children made up 13.4% of pediatric burn centre admissions [23]. Ryan et al. [23] reported that Indigenous children were overrepresented compared to non-Indigenous children by a factor of 10:1 in their burn unit. Similarly, A retrospective review of burn patients in Northern Alberta from 1977 to 1986 demonstrated that 7.8% of all admissions were Indigenous, despite Indigenous peoples making up only 4.3% of the population served by that burn centre [24].

A retrospective database review of data from the British Columbia Professional Firefighters Burn Unit burn registry database from 1979 to 2009 demonstrated varying incidence of burn injury in the Indigenous population across different time spans [25]. Census data showed Indigenous people made up approximately 5.4% of the population in this region during the study period. Trends were reported per five-year period, during which Indigenous burn admissions made up varying percentages of total admissions, the least being between 2000–2004 where they made up 2.8% of total admissions. A greater percentage of total admissions were identified in Indigenous persons between 2005–2009 where they made up 14.7% of total admissions.

3.4.2. *United States of America*

A study of the NBR data from burn patients admitted to reporting burn units between 2002 to 2009 indicated 0.7% of their sample was Indigenous, which is significantly less than the overall population rate [26]. Data from the NBR registry

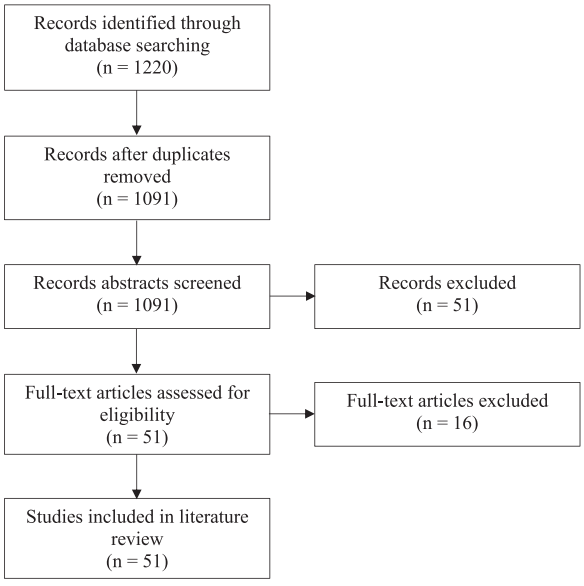

Fig. 1 – Review Flow Diagram.

between 1995 to 2007 of patients under 18 years of age indicated an incidence of injury in the Indigenous population roughly equal to their population makeup [27]. In contrast, a retrospective analysis of burn patients admitted to Arizona's burn centre found 955 of their 10,521 admissions between 2000–2015 were Indigenous; an incidence of approximately 10.11% [28]. When compared to Arizona's recent census data indicating an Indigenous population of 5.5%, this demonstrates an overrepresentation in burn hospitalisations for their Indigenous population [29].

3.4.3. *Australia*

Four studies indicated that Australia's Indigenous populations are significantly over-represented in burn hospitalisation. A Western Australia Safety and Quality of Surgical Care Project database review extracted all hospital morbidity and mortality records of burn admissions between 1983 and 2008 which included of 23,450 burn admissions. Their review showed that Indigenous people experienced burn injury hospitalisation at an incidence 3.8 times higher than non-Indigenous people [30]. Indigenous adolescents were over 2.3 times more likely to suffer a burn injury [31]. Ryder et al. [32] found that Indigenous children made up 10.8% of admissions compared to the Indigenous population makeup of 5.3% in their retrospective database analysis between 2009 and 2018. In contrast, a study investigating presentation of burn injuries at outpatient minor burn clinic showed Indigenous people had a lower incidence of presentation to the clinic compared to their population rate [33].

3.4.4. *New Zealand*

Mistry et al. [34] found that Indigenous people had the highest incidence of burn injury admission compared to other ethnic groups. They also found that the incidence of admission increased in proportion to socioeconomic deprivation. Indigenous children in both New Zealand and Australia were overrepresented in scald burn injuries with hospitalization and were more than three times as likely to be admitted to hospital for a scald injury compared to other children [35].

3.4.5. *Circumstance of injury*

Indigenous Canadians admitted to the burn centre in British Columbia were more likely to present with what the authors identified as contributing factors, including alcohol/drug use, accelerants, cigarettes, epilepsy, and psychiatric conditions [25]. The study did not identify specifically how these factors contributed to injury. A NBR data review comparing

Table 2 – Database Search Method.

CINAHL and SocINDEX	Ovid MEDLINE	PSYCinfo
1. Burns or burn or disfigur*or deformit* or scars or scarring or scarred or "thermal injur* " or scald	1. (burn or burns or disfigure* or deformit* or scars or scarred or thermal injur* or scald).mp.	1. (Burns or burn or disfigur* or deformit* or scars or scarring or scarred or thermal injur* or scald).mp.
2. (Aboriginal or "First Nation*" or Indigenous or Inuit or Metis or Eskimo or "Pacific Islander*" or "Torres Strait Islander*" or Indian or Maori) OR (Native* N1(Alaska* or Hawaiian* or American* or Canadian* or Australian*)) OR ("American Indian*"or Amerindian*) OR (Native* N1(man or men or women or woman or boy*or girl* or child* or adolescent* or youth or youths or person* or adult* or people* or Indian or Indians or Nation or Nations or tribe* or tribal or band or bands or community or communities or group or groups or population* or patient*))	2. (Aboriginal or First Nation or Indigenous or Inuit or Metis or Eskimo or Pacific Islander* or Torres Strait Islander* or Indian or Maori or (native* adj(Alaska* or Hawaiian* or American* or Canadian* or Australian*))).mp.	2. (Aboriginal or First Nation* or Indigenous or Inuit or Metis or Eskimo or Pacific Islander* or Torres Strait Islander* or Indian or Maori or (native* adj (Alaska* or Hawaiian* or American* or Canadian* or Australian*))).mp.
3. S1 and S2	3. (American Indian* or Amerindian).mp.	3. (American Indian* or Amerindian*).mp.
	4. (Native* adj(man or man or men or women or woman or boy* or girl* or child* or adolescent* or youth or youths or person* or adult* or people* or Indian or Indians or Nation or Nations or tribe* or tribal or band or bands or community or communities or group or groups or population* or patient*)).tw,kf.	4. (Native* adj (man or men or women or woman or boy* or girl* or child* or adolescent* or youth or youths or person* or adult* or people* or Indian or Indians or Nation or Nations or tribe* or tribal or band or bands or community or communities or group or groups or population* or patient*)).mp.
	5. 2 or 3 or 4	5. 2 or 3 or 4
	6. 1 and 5	6. 1 and 5

characteristics associated with burn injury found alcohol abuse was characteristic in 16.1% of the Indigenous people in their sample which was 10% higher than in the Caucasian group which had the next highest rate of alcohol abuse [26]. Indigenous Americans admitted to Arizona Burn Center were more likely to be tested for blood alcohol than non-Indigenous admissions (26.9% compared to 21%) and more likely to have positive blood alcohol tests (45.7% compared to 18.2%)[28]. Callegari et al. [24] found that 7.2% of Indigenous patients over a 10-year period at one burn centre were burned in criminal circumstances, which included child abuse, deliberate acts, and suicide, compared to 2.8% of the non-Indigenous population in Northern Alberta, Canada.

An Australian retrospective cohort data analysis of all patients admitted to The Royal Darwin Hospital that met Burns Registry of Australia and New Zealand criteria demonstrated that Indigenous women were more likely to be affected by an interpersonal violence burn injury than non-Indigenous women [36]. Harre et al. [37] determined that Indigenous children in New Zealand were more likely to be involved in burn risk related activities in the home at younger ages compared to other children. Indigenous people were also found to be more likely to be burned in recreational activities or at home in one Canadian and one US study, compared to other populations [25,28]. Swann et al. [28] found that Indigenous people were more likely to be burned during winter months and hypothesized that this may be due to unsafe heating resources. In addition, Indigenous people in an Australian cohort analysis were found to have the lowest rate of self-applied burn first aid treatment, which can cause more severe injuries and therefore more burns that involve hospitalisation [38].

3.4.6. *Etiology of burn injury*

Four studies included data on differences in burn etiology. Papp & Hawthorthwaite [25] found that Indigenous people were more likely to suffer from flame burns than any other ethnic group included in their Canadian study. Conversely, Swann et al. [28] found no significant difference in incidence of flame burn between their Indigenous and non-Indigenous population in Arizona but did find that Indigenous people were significantly more likely to suffer a contact burn. Pediatric Indigenous Americans were more likely to suffer an inhalation burn than non-Indigenous American children [27]. Ryan et al. [23] found that Indigenous children in Northern Alberta, Canada were significantly more likely to have a flame burn than non-Indigenous children. Indigenous children were more likely to suffer an injury from flame rather than a scald, which contrasts general trends of paediatric burns where scalds are most common.

3.4.7. *Injury severity*

In one Canadian study, Indigenous people tended to present with more severe injuries compared to other populations, with larger average total body surface area and increased depth of injury [25]. Despite this, they observed a lower mortality amongst Indigenous patients compared with the Caucasian population which they hypothesized might indicate preadmission fatalities amongst the Indigenous population that were not captured [25]. Callegari et al. [24] also found that Indigenous patients had larger total body surface area (TBSA) on average than non-Indigenous burn patients in Northern Alberta, Canada. In Australia, Moller et al. [39] found that Indigenous children were more likely to have a burn of over 10% TBSA. Conversely, the Indigenous population in Arizona, US were found to be less severely burned with smaller TBSA than other populations [28].

3.4.8. *Length of stay*

Indigenous populations were reported to have a longer length of stay (LOS) than non-Indigenous populations in six retrospective or prospective data analysis studies across Canada, US, and Australia [24–26,28,39,40]. Indigenous people in Northern Alberta were found to have a LOS of approximately 17 days longer on average than non-Indigenous patients [24]. In British Columbia, Indigenous patients had the longest LOS, with a mean of 31 days compared to 24 days average across all ethnicities in the study [25]. Indigenous Canadians in this study were more likely to present with more severe injuries, which likely accounted for the difference in LOS [25].

Indigenous Americans in a US study were found to have statistically significant longer LOS, with a minimum of 3.8 days longer than the average of all patients [26]. The same study reported the highest number of complications for the Indigenous American population which would demonstrate concordance with the increased LOS. In Arizona, Indigenous burn patients had a mean LOS of 11.94 compared to mean of 10.78 for non-Indigenous patients [28]. This study found that Indigenous Americans were less severely burned but did undergo more surgery on average which may account for the difference.

In a population-based cohort analysis, Indigenous pediatric burn patients in Australia had a longer mean LOS by almost three days which was statistically significant after adjusting for burn characteristics and rurality [39]. In a study of Indigenous Australian pediatric patients, burn severity, complex treatments (skin grafting), and rural residency all contributed to increased LOS [40].

3.4.9. *Complications and mortality*

According to a retrospective NBR review analyzing patient and social characteristics that contributed to disparities in burn injury outcomes, Indigenous American burn patients had the highest prevalence of complications associated with injury including respiratory, infectious, graft, and wound complications and renal failure [26]. A study of adult burn patients with hypertrophic scar formation found that Indigenous ethnicity was an independent risk factor for hypertrophic scarring, as well as facial burns and burns of over 20% TBSA [41]. In another study of hypertrophic scarring risk factors, Indigenous Americans were found to have a hypertrophic scarring prevalence ratio of 1.98 compared to Caucasians [42]. Asian, African American, and Indigenous race were all found to be independent risk factors for hypertrophic scarring, in addition to burn size and number of operations [42]. A study of fire related deaths demonstrated that Indigenous Americans had an incidence ratio of 1.93 compared to Caucasians [43]. Conversely, mortality rate between Indigenous and non-Indigenous burn patients in northern Alberta were similar, 4.8 compared to 4.3% [24].

3.4.10. *Experiences of care*

3.4.10.1. *Cultural safety*. A study of Australian and international burn injury models of care suggested that the six models studied had gaps in cultural safety and lacked explicit guidelines for addressing cultural safety in caring for Indigenous patients [44]. Williams et al. [45] performed a systematic review to determine the cultural appropriateness of psychosocial interventions for Indigenous pediatric burn patients and their caregivers. They were unable to come to any conclusion on the cultural appropriateness of interventions as the studies included in their review did not include assessment of effectiveness for the Indigenous population, despite their overrepresentation in burn injuries. Families of First Nation pediatric burn patients in Australia described experiences of lack of cultural safety in their child's burn care including disempowerment and judgement [46]. Indigenous healthcare providers and liaisons were a recognised facilitator of cultural safety from many perspectives; however, they were under-resourced, and under-utilized [47,48].

3.4.10.2. *Healthcare provider perspectives*. A study of multidisciplinary team members from several burn centres in Australia found that most burn team members had difficulty differentiating between equitable and equal care. From this studies' working definitions, equal care was a state of equal rights and opportunities, whereas equitable care was the absence of avoidable differences between groups of people [49]. Inequity was defined as unfair differences or disparities in health that are avoidable [49]. Many team members stated their care of Indigenous populations as being equal to what they provide others, yet described racial stereotyping, assuming patient's ethnicity and associated needs based on skin color, and reported providing differential care for those people [49]. In a qualitative study of 18 families of child burn injury patients, Indigenous health workers were described as valuable but were also described as under resourced and therefor often unavailable to be utilized [47] Additionally, although most healthcare workers recognized the importance of Indigenous health workers and liaisons, they failed to include them in multidisciplinary rounds [47].

3.4.10.3. *Patient and family perspectives*. Coombes et al. [46] found that families expressed many difficulties with burn care, including lack of culturally sensitive communication. Families reported a lack of culturally appropriate resources and felt confused about what to expect after discharge. They also reported lack of recognition of the trauma and related psychological challenges faced because of the injury. Indigenous health workers were the main facilitator of improved care identified in hospital settings [47].

Lack of local support for aftercare also posed a significant barrier. In addition to difficulties with ongoing care, families also described financial and social losses. The families studied valued their communities and support systems at home, but had no access aftercare in their communities, so had to continue to travel [46]. Disconnection from family and community due to time away from home was also described as a significant loss to families [32,46]. Families also expressed difficulties with financial strain from travel costs to and from hospital, hotels, food, and care after discharge [32].

4. Discussion

This literature review demonstrated that incidence and severity of burn injuries across time, geographical areas, and populations generally indicates higher incidence of injury and poorer outcomes amongst Indigenous people. Indigenous people are more likely to suffer burn injuries at home or recreationally. Several studies identified Indigenous burn patients as being more likely to present with alcohol consumption close to injury and they are more likely to suffer a flame burn than non-Indigenous populations. These studies frequently failed to address possible contributing factors faced by Indigenous people such as poverty, inadequate housing, or lack of safe heating sources [6].

In recovery, Indigenous burn survivors have increased complications including infection and graft failure. Increased length of stay in the Indigenous burn survivor population was reported consistently, and in addition to increased complications some studies identified, rurality of survivors was reported as another factor contributing to the increased length of stay. They also had increased risk of dysfunctional skin from hypertrophic scarring which contributes to deformity.

Most of the current burn research in the Indigenous population includes epidemiological studies and data reviews. Data for each of these reviews is limited by the characteristics of data collected and reported by each institution. The National Burn Repository collects data mainly from burn centres across the US, as well as from some Canadian and international centres. The NBR recognizes limitations in the reported data as many datasets they receive from burn centres are incomplete [50]. This could account for the significant difference in reported injury rate compared to studies performed at individual centres. Furthermore, individual centres included in the study have variable quality of reliable identification of Indigeneity. For example, no indicators collected for Indigenous identity are available in Alberta's provincial health authority data.

Qualitative research on the topic only addresses pediatric Indigenous burn care in Australia. Although these studies were not performed in Canada, we find potential parallels in challenges that might be faced by the Canadian Indigenous burn population. These potential parallels include strain on families having to travel long distances to burn centres, lack of culturally appropriate care from healthcare providers, and the value of Indigenous liaisons in the healthcare setting.

The authors recognize that despite potential similarities, significant variance among Indigenous Nations are common both across and within countries including differences in values, economic resources, language, and cultural practices that could impact reintegration outcomes. Findings in the US, Australia, and New Zealand of burn injured Indigenous peoples may have some similarities to Canada's Indigenous populations but cannot be considered reliable parallels. Only four of the 35 studies identified in this review addressed burns in Indigenous Canadians, and only one was published within the last 25 years. Three of those studies demonstrated

increased incidence or severity of injury or outcome in Canada's Indigenous population. Lack of further research in this area demonstrates a significant gap in Canadian healthcare literature.

It is well known that anti-Indigenous racism continues to be a problem in healthcare [51]. Indigenous Canadians experience worse health outcomes compared to the general population in many disease states [52]. Studies of other disease states show that decreased specialist utilization amongst Indigenous people is multifactorial. Even for urban living Indigenous people, economic, social, and cultural barriers associated with systemic racism and intergenerational trauma continue to impede Indigenous people's access to care [52].

A study of arthritis in Indigenous Canadians showed that Indigenous people were often 'toughing out' their disease, in a culture where traumatic events and struggle have become a normal part of many Indigenous people's lives [1]. Prior negative experiences with healthcare systems and providers were also a significant barrier to care access [1]. Furthermore, appointment times have also been found to be a barrier to specialist access as they often do not align with Indigenous people's values, and when appointments were missed it contributed to increased negative framing from providers around lack of patient 'buy in' to their care [1]. Policies for creating culturally safe environments and relationships, and improving patient access are key in retaining engagement in care [1].

The highly specialized nature of burn care necessitates the isolation of centres to specific urban areas. The location of these centres makes it difficult for anyone who lives rurally or outside of those cities to access their care, however it is not possible for such specialized care to be geographically convenient for each citizen. Lack of follow up for important ongoing care after discharge could be assumed to be purely a matter of distance, inconvenience, or lack of resources. However, it could also reflect the trends in decreased specialist care utilization by Indigenous peoples in other disease state studies indicating that previous experiences of racism and lack of providers' understanding of Indigenous people's values contributes to lack of engagement in continued care [1]. Burn care providers have little impact on incidence, etiology, and severity of injuries that present to the burn centres that employ them. However, burn care providers can enact culturally appropriate and sensitive care to each patient that decreases barriers to Indigenous people accessing important ongoing care.

Continued support in after-care for burn survivors is important in helping survivors achieve positive reintegration outcomes. Without research on the experiences of Indigenous burn survivors in Canada, we cannot determine the effectiveness of current follow-up care and programming for this population nor which outcome markers are most important to them. Research can affect change in the practice settings to increase culturally appropriate resources by identifying gaps in current care practices from Indigenous burn survivors' perspectives. Furthermore, research with Indigenous burn survivors can demonstrate the need for resources directed at programming that makes care more accessible and provides support curated for Indigenous survivors.

4.1. *Conclusion*

Canadian research available on burn injuries in Indigenous peoples is scarce. Current research demonstrates that Indigenous people have a higher incidence of injury and frequently suffer more severe injuries with increased complications. International research further demonstrates that the needs of Indigenous burn patients may not be appropriately met by current practices. More focused research on burn injuries in Indigenous Canadians is needed for care and outcomes to be improved for this population. Qualitative research in this area can be undertaken with a decolonizing approach with Indigenous people that honours Indigenous ways of knowing. The researchers are currently undertaking a qualitative study in southern Alberta, Canada to learn more about the experiences of Indigenous burn survivors, in hopes of improving care and developing resources for this population.

CRediT authorship contribution statement

Leah Verburg: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing. **Vincent Gabriel:** Conceptualization, Methodology, Writing – review & editing, Supervision, Funding acquisition. **Graham McCaffrey:** Conceptualization, Methodology, Writing – review & editing, Supervision.

Declaration of Competing Interest

Authors have no conflicts of interest to declare. This manuscript, including related data, figures and tables has not previously been published. The manuscript is not under consideration elsewhere.

Acknowledgements

Authors of this manuscript have no conflicts of interest to declare. We would like to acknowledge Dr. Alix Hayden, Faculty of Nursing Librarian at the University of Calgary for helping curate the search strategy. Funding was received from the Calgary Firefighters Burn Treatment Society.

REFERENCES

[1] Thurston WE, Coupal S, Jones CA, Crowshoe LF, Marshall DA, Homik J, et al. Discordant indigenous and provider frames explain challenges in improving access to arthritis care: a qualitative study using constructivist grounded theory. Int J Equity Health 2014;13:46. https://doi.org/10.1186/1475-9276-13-46

[2] World Health Organization. Burns. 2018. ⟨https://www.who.int/news-room/fact-sheets/detail/burns⟩.

[3] Capek KD, Sousse LE, Hundeshagen G, Voigt CD, Suman OE, Finnerty CC, et al. Contemporary burn survival. J Am Coll Surg 2018;226:453–63. https://doi.org/10.1016/j.jamcollsurg.2017.12.045

[4] American Burn Association. Annual burn injury summary report 2020 update. 2020. ⟨https://ameriburn.org/quality-care/2020-bisr/⟩.

[5] Peters J, Bello MS, Spera L, Gillenwater TJ, Yenikomshian HA. The impact of race/ethnicity on the outcomes of burn patients: a systematic review of the literature. J Burn Care Res 2022;43:323–35. https://doi.org/10.1093/jbcr/irab174
[6] Statistics Canada. (2021). Mortality and morbidity related to fire, burns and carbon monoxide poisoning amount First Nations people, Métis and Inuit: Findings from the 2011 Canadian Census Health and Environment Cohort. Retrieved from ⟨https://publications.gc.ca/collections/collection_2021/statcan/CS2–54-2021-eng.pdf⟩.
[7] Statistics Canada. (2021). Inidgenous identity of a person. Retrieved from ⟨https://www23.statcan.gc.ca/imdb/p3Var.pl?Function=DEC&Id=42927⟩.
[8] Indigenous Services Canada. Indian status. 2023. ⟨https://www.sac-isc.gc.ca/eng/1100100032374/1572457769548⟩.
[9] Blanchet Garneau A, Bélisle M, Lavoie P, Laurent Sédillot C. Integrating equity and social justice for indigenous peoples in undergraduate health professions education in Canada: a framework from a critical review of literature. Int J Equity Health 2021;20. https://doi.org/10.1186/s12939-021-01475-6
[10] Griffiths K, Coleman C, Lee V, Madden R. How colonisation determines social justice and Indigenous health—a review of the literature. J Popul Res 2016;33:9–30. https://doi.org/10.1007/s12546-016-9164-1
[11] Graham HS, L. L. Contemporary perceptions of health from an Indigenous (Plains Cree) perspective. Int J Indig Health 2010;6:6–17. https://doi.org/10.3138/ijih.v6i1.28992
[12] Jimenez N, Garroutte E, Kundu A, Morales L, Buchwald D. A review of the experience, epidemiology, and management of pain among american indian, alaska native, and aboriginal Canadian peoples. J Pain 2011;12:511–22. https://doi.org/10.1016/j.jpain.2010.12.002
[13] Jeschke MG, Van Baar ME, Choudhry MA, Chung KK, Gibran NS, Logsetty S. Burn injury. Nat Rev Dis Prim 2020;6. https://doi.org/10.1038/s41572-020-0145-5
[14] Young AW, Dewey WS, King BT. Rehabilition of burn injuries: an update. Phys Med Rehabil Clin North Am 2019;30. https://doi.org/10.1016/j.pmr.2018.08.004
[15] Burnett LN, Carr E, Tapp D, Raffin Bouchal S, Horch JD, Biernaskie J, et al. Patient experiences living with split thickness skin grafts. Burns 2014;40:1097–105. https://doi.org/10.1016/j.burns.2014.03.005
[16] Finnerty CC, Jeschke MG, Branski LK, Barret JP, Dziewulski P, Herndon DN. Hypertrophic scarring: the greatest unmet challenge after burn injury. Lancet 2016;388:1427–36. https://doi.org/10.1016/s0140-6736(16)31406-4
[17] Chiang RS, Borovikova AA, King K, Banyard DA, Lalezari S, Toranto JD, et al. Current concepts related to hypertrophic scarring in burn injuries. Wound Repair Regen 2016;24:466–77. https://doi.org/10.1111/wrr.12432
[18] Grieve B, Shapiro GD, Wibbenmeyer L, Acton A, Lee A, Marino M, et al. Long-term social reintegration outcomes for burn survivors with and without peer support attendance: a life impact burn recovery evaluation (LIBRE) study. Arch Phys Med Rehabil 2020;101:S92–8. https://doi.org/10.1016/j.apmr.2017.10.007
[19] Kornhaber R, Childs C, Cleary M. Experiences of guilt, shame and blame in those affected by burns: a qualitative systematic review. Burns 2018;44:1026–39. https://doi.org/10.1016/j.burns.2017.11.012
[20] Martin L, Byrnes M, McGarry S, Rea S, Wood F. Social challenges of visible scarring after severe burn: a qualitative analysis. Burns 2017;43:76–83. https://doi.org/10.1016/j.burns.2016.07.027
[21] Prevention CfDCa. Disability and Health Overview. ⟨https://www.cdc.gov/ncbddd/disabilityandhealth/disability.html⟩.
[22] Blakeney P, Partridge J, Rumsey N. Community integration. J Burn Care Res 2007;28:598–601. https://doi.org/10.1097/bcr.0b013e318093e493
[23] Ryan CA, Shankowsky HA, Tredget EE. Profile of the paediatric burn patient in a Canadian burn centre. Burns 1992;18:267–72. https://doi.org/10.1016/0305-4179(92)90146-l
[24] Callegari PR, Alton JDM, Shankowsky HA, Grace MGA. Burn injuries in native Canadians: a 10-year experience. Burns 1989;15:15–9. https://doi.org/10.1016/0305-4179(89)90062-4
[25] Papp A, Haythornthwaite J. Ethnicity and etiology in burn trauma. J Burn Care Res 2014;35:e99–105. https://doi.org/10.1097/bcr.0b013e3182a223ec
[26] Chen JH, Nosanov LB, Carney BC, Vigiola Cruz M, Moffatt LT, Shupp JW. Patient and social characteristics contributing to disparities in outcomes after burn injury: application of database research to minority health in the burn population. Am J Surg 2018;216:863–8. https://doi.org/10.1016/j.amjsurg.2018.01.028
[27] Kramer CB, Rivara FP, Klein MB. Variations in U.S. pediatric burn injury hospitalizations using the national burn repository data. J Burn Care Res 2010;31:734–9. https://doi.org/10.1097/bcr.0b013e3181eebe76
[28] Swann JA, Matthews MR, Bay C, Foster KN. Burn injury outcome differences in Native Americans. Burns 2019;45:494–501. https://doi.org/10.1016/j.burns.2018.09.018
[29] United States Census Bureau. (2021). QuickFacts Arizona. Retrieved from ⟨https://www.census.gov/quickfacts/AZ⟩.
[30] Duke J, Wood F, Semmens J, Spilsbury K, Edgar DW, Hendrie D, et al. A 26-year population-based study of burn injury hospital admissions in Western Australia. J Burn Care Res 2011;32:379–86. https://doi.org/10.1097/bcr.0b013e318219d16c
[31] Duke J, Wood F, Semmens J, Edgar DW, Spilsbury K, Rea S. An assessment of burn injury hospitalisations of adolescents and young adults in Western Australia, 1983–2008. Burns 2012;38:128–35. https://doi.org/10.1016/j.burns.2011.02.008
[32] Ryder C, Mackean T, Hunter K, Rogers K, Holland AJA, Ivers R. Burn injuries in hospitalized Australian children—an epidemiological profile. J Burn Care Res 2021;42:381–9. https://doi.org/10.1093/jbcr/iraa159
[33] Rea S, Wood F. Minor burn injuries in adults presenting to the regional burns unit in Western Australia: a prospective descriptive study. Burns 2005;31:1035–40. https://doi.org/10.1016/j.burns.2005.06.004
[34] Mistry RM, Pasisi L, Chong S, Stewart J, She RBW. Socioeconomic deprivation and burns. Burns 2010;36:403–8. https://doi.org/10.1016/j.burns.2009.05.021
[35] Riedlinger DI, Jennings PA, Edgar DW, Harvey JG, Cleland MHJ, Wood FM, et al. Scald burns in children aged 14 and younger in Australia and New Zealand—An analysis based on the Burn Registry of Australia and New Zealand (BRANZ). Burns 2015;41:462–8. https://doi.org/10.1016/j.burns.2014.07.027
[36] Murphy L, Read D, Brennan M, Ward L, McDermott K. Burn injury as a result of interpersonal violence in the Northern Territory Top End. Burns 2019;45:1199–204. https://doi.org/10.1016/j.burns.2019.01.013
[37] Harre N, Field J, Polzer-Debruyne A. New Zealand children's involvement in home activities that carry a burn or scald risk. Inj Prev 1998;4:266–71. https://doi.org/10.1136/ip.4.4.266
[38] Read DJ, Tan SC, Ward L, McDermott K. Burns first aid treatment in remote Northern Australia. Burns 2018;44:481–7. https://doi.org/10.1016/j.burns.2017.07.013
[39] Möller H, Harvey L, Falster K, Ivers R, Clapham KF, Jorm L. Indigenous and non-Indigenous Australian children hospitalised for burn injuries: a population data linkage study. Med J Aust 2017;206:392–7. https://doi.org/10.5694/mja16.00213

[40] Ryder C, Mackean T, Hunter K, Towers K, Rogers K, Holland AJA, et al. Factors contributing to longer length of stay in Aboriginal and Torres Strait Islander children hospitalised for burn injury. Inj Epidemiol 2020;7. https://doi.org/10.1186/s40621-020-00278-7
[41] Thompson CM, Hocking AM, Honari S, Muffley LA, Ga M, Gibran NS. Genetic risk factors for hypertrophic scar development. J Burn Care Res 2013;34:477–82. https://doi.org/10.1097/bcr.0b013e3182a2aa41
[42] Sood RF, Hocking AM, Muffley LA, Ga M, Honari S, Reiner AP, et al. Race and melanocortin 1 receptor polymorphism R163Q are associated with post-burn hypertrophic scarring: a prospective cohort study. J Invest Dermatol 2015;135:2394–401. https://doi.org/10.1038/jid.2015.197
[43] Bishai D, Lee S. Heightened risk of fire deaths among older African Americans and Native Americans. Public Health Rep 2010;125:406–13. https://doi.org/10.1177/003335491012500309
[44] Fraser S, Grant J, Mackean T, Hunter K, Holland AJA, Clapham K, et al. Burn injury models of care: a review of quality and cultural safety for care of Indigenous children. Burns 2018;44:665–77. https://doi.org/10.1016/j.burns.2017.10.013
[45] Williams HM, Hunter K, Clapham K, Ryder C, Kimble R, Griffin B. Efficacy and cultural appropriateness of psychosocial interventions for paediatric burn patients and caregivers: a systematic review. BMC Public Health 2020;20. https://doi.org/10.1186/s12889-020-8366-9
[46] Coombes J, Hunter K, Mackean T, Ivers R. The journey of aftercare for Australia's First Nations families whose child had sustained a burn injury: a qualitative study. BMC Health Serv Res 2020;20. https://doi.org/10.1186/s12913-020-05404-1
[47] Coombes J, Fraser S, Hunter K, Ivers R, Holland A, Grant J, et al. They are worth their weight in gold": families and clinicians' perspectives on the role of first nations health workers in paediatric burn care in Australia. Int J Environ Res Public Health 2021;18:2297. https://doi.org/10.3390/ijerph18052297
[48] Fraser S, Grant J, Mackean T, Hunter K, Keeler N, Clapham K, et al. What informs care? Descriptions by multidisciplinary teams about burns care for Aboriginal and Torres Strait Islander children. Burns 2020;46:430–40. https://doi.org/10.1016/j.burns.2019.07.039
[49] Fraser S, Grant J, Mackean T, Hunter K, Keeler N, Clapham K, et al. Considering difference: clinician insights into providing equal and equitable burns care for Aboriginal and Torres Strait Islander children. Aust NZ J Public Health 2021;45:220–6. https://doi.org/10.1111/1753-6405.13110
[50] American Burn Association. National burn repository 2016 report. 2016. ⟨https://ameriburn.org/wp-content/uploads/2017/05/2016abanbr_final_42816.pdf⟩.
[51] Bains C. (2022, September 30). No single fix for anti-Indigenous racism in Canada's healthcare system: doctor. The Canadian Press. ⟨https://www.ctvnews.ca/health/no-single-fix-for-anti-indigenous-racism-in-canada-s-health-care-system-doctor-1.6090855⟩.
[52] Harasemiw O, Komenda P, Tangri N. Addressing inequities in kidney care for indigenous people in Canada. J Am Soc Nephrol 2022;33:1474–6. https://doi.org/10.1681/asn.2022020215