

SYSTEMATIC REVIEW

Assessment, management and prevention of acute wounds in the Australian context: a scoping review

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Abstract

Aim To undertake a scoping review of research on the assessment, management and prevention of acute wounds, from both primary research studies in Australia and from worldwide synthesised evidence, in order to provide a global context of future research needs.

Methods Databases, trial registries and professional organisation websites were searched from January 2010 to April 2022 inclusive. All Australian research studies, in addition to worldwide reviews and guidelines, were included. Articles were reviewed by two independent researchers and conflicts were resolved by a third researcher. Results were synthesised in a narrative review.

Results The searches yielded 318 Australian studies and 833 international studies, the latter comprising of 680 systematic reviews (SRs), 28 evidence-based guidelines (EBGs), 79 evidence summaries and 46 consensus documents. The Australian research studies consisted mostly of cohort studies, focused on burns (46%) and surgical wounds (44%), with fewer studies on skin tears and other acute wound types. Australian studies were primarily investigating wound management or treatments (60%), with only 38% on assessment and 2% on the prevention of wounds.

Conclusions This review found research on acute wounds focused on surgical wounds and burns, with gaps in research on skin tears or traumatic wounds, wound prevention, and research in primary healthcare settings, despite the high prevalence of wounds cared for in these settings.

Keywords acute wounds, burns, traumatic wounds, skin tears, surgical wounds

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Introduction

Acute wounds such as surgical wounds, burns, traumatic wounds and skin tears constitute the wound types most frequently encountered by health professionals.^{1,2} Prevalence surveys have reported the majority of wounds in hospital and outpatient community settings were acute/surgical wounds (76% and 35% in each setting respectively),¹ and 56% of wounds cared for in an Australian community nursing service were acute wounds or skin tears.² Their management consumes significant healthcare resources, estimated as

1.6–2.4% of total health service costs¹, with a reported cost of A\$390,641 to treat a sample of 1053 acute wounds in a recent Australian study.³ An acute wound can be defined as “a recent wound, of any aetiology” that is expected to progress “through the normal sequential to achieve healing”.^{4(p.2)} Definitions of acute wound types are provided in Box 1.⁵⁻¹⁰ However, despite their frequency of occurrence, inconsistency in management is frequently reported.^{11,12}

The implementation of research evidence into clinical practice has been shown to deliver safe, cost-effective wound care

and improved patient outcomes.^{13,14} Considering the high burden of acute wounds on individuals and healthcare systems outlined above, it is essential to review available research findings to provide the means to optimise care delivery and facilitate more efficient and cost-effective utilisation of healthcare resources. The Australian Health Research Alliance Wound Care Initiative aimed to address wound care challenges, lower the health burden of wound care in Australia, and develop a national and integrated approach to wound management and research that can be readily embedded in the Australian health system. One activity under this initiative was to review research findings on wounds (acute, chronic and fundamental science of wound healing) to guide the future direction of Australian wound research through the identification of research gaps and priorities.

This scoping review aimed to identify research on the assessment, management and prevention of acute wounds,

from 1) primary research studies conducted in Australia, and 2) worldwide synthesised evidence available within systematic reviews (SRs), evidence-based guidelines (EBGs), evidence summaries and consensus documents to provide a global context. The research questions guiding the review were:

- What are the characteristics of Australian research on the assessment, management and prevention of acute wounds?
- What research evidence is available in the global context in synthesised research documents and guidelines on the assessment, management and prevention of acute wounds?
- What are the research gaps specific to the assessment, management and prevention of acute wounds in Australia?

Methods

This scoping review is reported in accordance with the guidance provided by the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist¹⁵ and the Joanna Briggs Institute (JBI) scoping review methodology.¹⁶ The review protocol was prospectively registered in the Open Science Framework (<https://osf.io/bzs38>) and published in Sandy-Hodgetts et al.¹⁷

Eligibility criteria

Inclusion criteria:

- Original qualitative or quantitative studies on the assessment, management or prevention of acute wounds conducted in Australia.
- Published in English.
- Worldwide EBGs, evidence summaries, consensus documents and SRs on the assessment, management or prevention of acute wounds.
- Human studies with adults aged from 18 years and older. Note that epidemiological studies were identified which provided data from both adults and younger age groups. These were included, as the data provided on adult wound prevalence was valuable.
- Any setting (e.g., community, general practice, outpatient department, residential aged care facilities, hospitals).
- Published between 1 January 2010 to 30 April 2022.

Exclusion criteria:

- Case series, case study or studies, editorials, general literature reviews.
- Conference abstracts, and conference proceedings.

Information sources

Sources were MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Embase, Joanna Briggs Institute, Cochrane Library, American Psychological Association PsycInfo, Australian and New Zealand Clinical

<p>Surgical wound</p> <p>“A wound created when an incision is made with a scalpel or other sharp cutting device and then closed in the operating room by suture, staple, adhesive tape, or glue and resulting in close approximation to the skin edges”^{5(p.10)}</p>
<p>Surgical wound complication</p> <p>“A disruption to the normal healing process following surgery and includes surgical site infection, surgical wound dehiscence, peri wound maceration, hypergranulation and medical adhesive related skin injury”^{6(p.4)}</p>
<p>Burn wound</p> <p>“Burns are injuries to the skin that occur when the skin or other tissues are damaged by contact with heat (scales from liquids spilled or liquid immersion, grease or steam; contact burns; and fire, flash or flame), electricity, radiation or chemicals”^{7(p.5)}</p>
<p>Scar</p> <p>“The formation of fibrous tissue replacing normal tissue following trauma, surgery or disease... scarring covers a wide spectrum of clinical phenotypes from normal fine lines to abnormal widespread, atrophic, hypertrophic, and keloid scars and scar contractures”^{8(p.88)}</p>
<p>Traumatic wounds</p> <p>“Wounds resulting from injury, range from minor lacerations to those with extensive tissue damage”^{9(p.3)}</p>
<p>Skin tear</p> <p>“A wound caused by shear, friction, and/ or blunt force resulting in separation of skin layers. A skin tear can be partial-thickness (separation of the epidermis from the dermis) or full-thickness (separation of both the epidermis and dermis from underlying structures)”¹⁰</p>

Box 1. Definitions of acute wound types

Trials Registry, International Standard Randomised Controlled Trials Registry and ClinicalTrials.gov. Websites and publications of professional associations for wound management included Wounds Australia, Wounds UK, Wounds International, Wounds Canada, European Wound Management Association, International Wound Infection Institute, International Surgical Wound Complications Advisory Panel, National Institute for Health and Care Excellence, World Health Organization, Wound Healing Society, World Union of Wound Healing Societies and New Zealand Wound Care Society.

Search strategy

Databases and sites were searched for published literature fitting the inclusion criteria between 1 January 2010 to 30 April 2022. Key search terms were wound, incision, laceration, site, skin tear, surgical, postoperative, operative, trauma and burns. Limiters included only studies conducted with human participants, research articles, and studies published in English language. An example full search strategy is shown in Table 1.

Selection of documents

Results from searches were imported into EndNote X9. After excluding duplicates, two levels of screening were used to identify articles to be included: (i) title and abstract screening and (ii) full text screening. At each level, search results were reviewed by two independent researchers, and any disagreements reviewed by a third reviewer.

Data extraction

A data extraction tool was developed by one of the researchers and pilot tested and reviewed by two other researchers. Data were independently extracted by one researcher and cross checked against original articles by a second researcher to ensure the accuracy of extracted information. Data extracted included (i) study characteristics, (ii) research design or document type, (iii) type of acute wounds, (iv) study population, (v) focus topic and (vi) main outcomes.

Table 1. Search strategy example for Australian original research studies

Search ID#	Search terms
#1	(wound* OR incision* OR lacerat* OR site OR (skin tear*) OR burn*) [title/abstract]
#2	(surg* OR postoperat* OR post-operat* OR operat* OR trauma* OR burn* OR lacerat* OR (skin tear*)) [title/abstract]
#3	(Australia OR Australian OR Australians) [all text]
#4	#1 AND #2 AND #3
Limiters: published date 20100101–20220430, human, adult, peer reviewed, English	

Synthesis of results

Results were grouped and reported according to the type of acute wound the study or document focused on, i.e., surgical, burns, traumatic wounds, skin tears or samples with mixed types of acute wounds. Results were then organised under sections on the assessment, management or prevention of each type of wound. A narrative synthesis is reported in each section on the amount and types of studies and documents, primary focus topics, and an overview of results from the Australian studies.

Results

Following the searches, 10,543 potential articles were found. Of these, 2106 were duplicates, and 7286 articles did not fit the inclusion and exclusion criteria, including 251 articles which focused on non-wound related primary outcomes of surgical techniques. These articles are available in Supplementary file A. Of the 1151 remaining included articles, there were 318 Australian studies (294 quantitative studies and 24 qualitative studies), and 833 international studies (680 SRs, 28 EBGs, 79 evidence summaries and 46 consensus documents). Figure 1 displays the flow diagram of document inclusion. Australian documents on assessment (38%) included 120 quantitative studies and one qualitative study, documents on management (60%) included 179 quantitative studies and 11 qualitative studies, while documents on prevention (2%) included seven quantitative studies. Specific study designs of the included articles are displayed in Table 2. Due to the large number of SRs, references for the SRs are available in Supplementary file B.

The largest number of documents were on surgical wounds (n=727, 63%), followed by burns (n=288, 25%), samples of mixed acute wound types (n=62, 5%), traumatic wounds (n=42, 4%), and skin tears (n=32, 3%). Of the Australian original research studies, 46% (n=148) were on burns, 44% (n=139) on surgical wounds, 6% (n=18) on skin tears, 3% (n=9) on traumatic wounds, and 1% (n=4) on mixed acute wound types. The most frequent research design of Australian studies was observational cohort studies (48%). Australian studies concentrated on wound management (60%), with only 38% on assessment, and 2% on the prevention of wounds.

The majority of Australian studies were conducted in hospital settings (78%), 7% were in follow-up care settings (outpatients, rehabilitation), 3% in community care, 3% in residential aged care, 3% in specialist surgery clinics, 2% in emergency care (ambulance, ED), 2% in combined settings, and 2% in general practice. Most study samples consisted of adults with wounds or adults with the possibility of developing a wound (81%), 6% were epidemiological population samples, 5% were samples of health professionals, and 4% were samples of 'older adults', defined as either 50 years and over, 60 years and over, 65 years and over or 70 years and over. Two studies were conducted with samples of both patients and health professionals, and one study with young adults aged 15–29 years.

The most frequent topics of investigation of Australian studies for each wound type are displayed in Table 3. An overview of the findings is reported below by wound type and area of investigation (assessment, management and/or prevention).

Surgical wounds

The largest number of documents (n=727) focused on surgical wounds, including 139 Australian studies. Study designs and topics are shown in Tables 2 & 3.

Assessment

A total of 97 documents focused on assessment of surgical wounds – 35 Australian studies, three EBGs, one evidence summary and 58 SRs.

Australian studies

Most studies on surgical wound complications focused on surgical site infections (SSI). Reported SSI incidence rates varied across type of surgery and setting, from 0.5–18.9%.^{18–27} Two large studies found SSI rates decreased over time, i.e., SSI surveillance network data on cardiovascular, digestive, gynaecological-obstetrical, neurosurgical and orthopaedic surgery found decreased SSI rates over a median of 9 years

of data²⁸, while a Victorian surveillance program found decreased SSI rates from 2002–2013 from data on cardiac, Caesarean section, hip and knee prosthesis, colorectal, other abdominal, hysterectomy and vascular surgeries.²⁹ SSI rates varied according to procedure, with highest rates reported for colorectal survey²⁸ and orthopaedic surgery.²⁹ In contrast, a study of pelvic exenteration found increasing SSI rates from 1994–2006 data, to 2014–2017 data.³⁰ One study of hip replacement found an 8.8% incidence of wound complications in general.³¹

Results on risk factors for surgical wound complications are shown in Table 4. Looking at assessment tools or methods, one small 2012 study found superficial sternal wound swabs and blood cultures were useful in early diagnosis of deep sternal wound infection,³² while a study of fluorescence imaging found it improved sensitivity of bacterial detection³³.

Worldwide reviews (SRs, EBGs, evidence summaries, consensus documents)

Three EBGs covered assessment of surgical wounds^{5,34,35} in addition to one evidence summary on assessing SSIs.³⁶ The SRs focused on incidence of SSIs; risk factors or assessment tools for complications; and defining SSI.

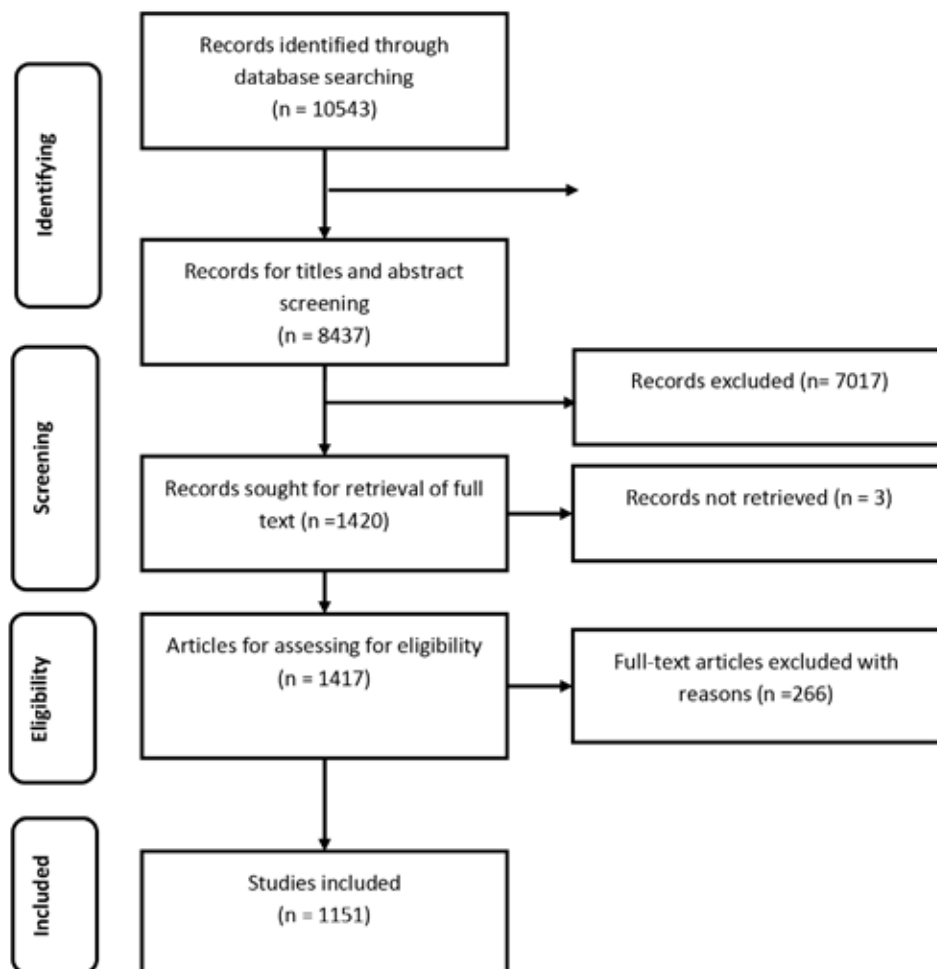


Figure 1. Full search strategy

Table 2. Study designs of included articles (n=1151)

RCT	Australian studies (n=318)										International evidence (n=833)			
	Quasi-experimental	Case control	Observation /cohort	Validity	Secondary analysis	Cross-sectional	Costs	Mixed methods	Qualitative	Registered trials	SR	EBG	Evidence summary	Consensus document
Surgical wounds														
37	3	6	53	2	2	17	5	3	2	9	541	15	16	16
Burns														
12	2	7	88	10	0	14	1	2	10	2	88	9	39	4
Mixed acute wounds														
0	1	0	1	0	0	1	0	1	0	0	20	2	19	17
Traumatic wounds														
2	0	0	5	0	0	1	0	1	0	0	28	1	3	1
Skin tears														
1	2	3	5	5	0	1	0	1	0	0	3	1	2	8
Total acute wounds														
52	8	16	152	17	2	34	6	8	12	11	680	28	79	46

Management

Surgical wound management was investigated in 104 Australian studies, in addition to 683 SRs, 15 evidence summaries, 15 EBGs and 16 consensus documents. Designs and topics of studies are shown in Tables 2 & 3.

Australian studies

Primary findings from intervention studies to prevent wound complications are listed in Table 5. Findings on interventions to promote healing included that: there were positive outcomes from a house advancement flap for pilonidal sinus³⁷ and V-Y advancement flaps for pretibial skin defects³⁸; there was no improvement in healing from warming or oxygenation³⁹; negative pressure wound therapy (NPWT) reduced the need for flap closure⁴⁰; there were no differences in healing between polyurethane vs calcium alginate dressings,⁴¹ or biosynthetic vs hydrocolloid dressings⁴²; pilonidal abscess incisions took longer to heal after a midline vs lateral incision⁴³; and there were increased complications from a 2cm excision margin compared to a 1cm margin for melanoma.⁴⁴ One study on pain management found intermittent wound infusion regimes were associated with greater reduction in pain scores.⁴⁵

On evidence-based practice (EBP), a qualitative study found barriers to EBP implementation were knowledge and skills deficits, access to protocols, suboptimal documentation and timing of education; while facilitators were active information seeking and patient participation.⁴⁶ Other results included that: there were significant gaps between EBGs and actual practices⁴⁷⁻⁵¹; evaluation of implementation strategies improved EBP^{52,53}; there were improvements adhering to antibiotic prophylaxis guidelines⁵⁴; content and accuracy of documented wound assessment was variable⁵⁵; and barriers in evidence-based wound management included traditional pretexts, economic factors, clinical knowledge and expertise and patient factors. Drivers were product choice, infection surveillance, interdisciplinary collaboration and regulatory mechanisms.⁵⁶

On costs, studies found that: surgical wound complications were associated with significant costs⁵⁷⁻⁶¹; NPWT for high-risk Caesarean section wounds was cost-effective⁶²; antibiotic prophylaxis and antibiotic impregnated cement in hip arthroplasty reduced costs⁶³; and reduced smoking rates before surgery would provide substantial economic benefits.⁶⁴ Studies on health service aspects reported that: wound care practice varied across clinical sites⁶⁵; a checklist improved documented wound management⁶⁶; wound care documentation did not meet Australian standards⁶⁷; and a qualitative study reported difficulties with postoperative advice when managing after Caesarean section.⁶⁸ Eight trial protocols were registered without reported results, on dressings, NPWT, smartphone

technology, skin preparation, surgical humidification, wound closure methods, care pathways, and topical medications.^{69–76}

Worldwide reviews

A total of 15 EBGs covered the management of surgical wounds, 13 on SSIs^{5,35,77–87}, and three including other surgical complications and/or strategies.^{34,78,88} There were 15 evidence summaries covering: NPWT⁸⁹; post-sternotomy mediastinitis⁹⁰; skin preparation^{91,92}; topical antibiotics⁹³; perioperative strategies to prevent SSI⁹⁴; delayed primary skin closure⁹⁵; SSIs caused by methicillin-resistant *Staphylococcus aureus* (MRSA)⁹⁶; skin graft and donor sites⁹⁷; and the OT environment.^{98–103} Consensus documents focused on: wound care and dressings¹⁰⁴; SSI prevention^{105–111}; skin graft donor sites¹¹²; wound dehiscence¹¹³; antibiotics after abscess excision¹¹⁴; NWPT^{115,116}; wound infection¹¹⁷; and preventing wound complications.^{10,118}

The SR topics included: skin preparation; glycaemic control; prophylactic antimicrobials; surgical hand antisepsis;

temperature-related interventions; surgical techniques; wound closing techniques; exudate management; NPWT; debridement; infection management; dressings; platelet treatments; laser therapy; postoperative showering; care bundles; pain management; OT environment factors; nutrition; scar management; costs; and combined management protocols or pathways. Further details on the SRs are available in Supplementary File B.

Burns

Burn wound care is complex as demonstrated by the number and diversity of documents (288), with 148 Australian research studies, 88 SRs, nine EBGs, 39 evidence summaries, and four consensus documents. The study designs and topics are shown in Tables 2 & 3.

Assessment

A third (33%) of the documents looked at assessment – 72 Australian studies, four evidence summaries, four EBGs and 15 SRs.

Table 3. Topics of investigation in Australian studies by wound type (n=318)

Focus topic of study	Surgical wounds (n=139)	Burns (n=148)	Mixed acute wounds (n=4)	Traumatic wounds (n=9)	Skin tears (n=18)
Prevalence/incidence of wound or complications	14	22	0	0	2
Risk factors or tools for wound occurrence, severity, complications, infection or delayed healing	27	32	1	3	9
Methods of assessing healing	0	6	0	0	0
Assessment tools or classification systems	0	9	0	0	1
Tissue characteristics/ assessment	0	3	0	0	1
Assessing/diagnosing infection	2	0	0	0	0
Assessing pain and symptoms	0	6	0	0	0
First aid	0	5	0	0	0
Skin preparation	6	0	0	0	0
Skin moisturisation	0	0	0	0	3
Topical wound treatments/dressings	6	7	0	1	0
Wound infection management or prevention	14	6	0	1	0
Scar management/prevention	3	5	0	0	0
Pharmacological interventions	6	0	0	0	0
Surgical interventions	10	4	0	2	0
Adjuvant therapies (NPWT, oxygenation, OT)	13	1	0	1	0
Pain and symptom management	2	9	0	0	0
Nutrition	0	3	0	0	0
Physical activity/exercise	1	2	0	0	0
Education	0	2	1	0	0
Self-management	0	2	0	0	0
Psychosocial factors, QoL	0	17	0	0	0
EBP/implementation studies	21	2	1	0	3
Health service management	7	3	1	1	1
Costs/cost-effectiveness	7	2	0	0	0

Table 4. Risk factors for surgical wound complications identified in Australian studies

Surgical wound complication / risk factors identified
SSI <ul style="list-style-type: none"> • Demographic: age^{311,312}, geography^{313,314}, gender^{315,316}, Indigenous ethnicity³¹⁷ • Comorbidities: higher BMI^{19,312,316,318-321}, diabetes^{317,321}, rheumatoid arthritis³¹², heart disease^{316,321}, ulceration³²² • Medical history: systemic steroids³²³ (however, a study found dexamethasone was not associated with SSI³²⁴), warfarin³²⁵, number of previous operations^{321,326-328}, antihypertensives³²² • General health: smoking^{329,330} • Surgical factors: excisions on extremities^{311,329}, BCC or SCCs, larger excisions³²⁹, polypropylene mesh vs comparable products³³¹, emergency Caesarean sections³¹⁹, implantation of foreign material^{315,326,327}, myocutaneous flap repair in pelvic exenteration surgery³³², closure methods^{317,322}, operative duration³¹⁵, skin preparation³¹² • A Breast Reconstruction Risk Assessment tool was found valid to predict SSI³³³
Wound dehiscence <ul style="list-style-type: none"> • A risk assessment tool for dehiscence reported 71% predictive power³³⁴
Haematoma <ul style="list-style-type: none"> • Taking warfarin³²⁵
Split-skin graft failure <ul style="list-style-type: none"> • Increasing age, post-operative haematoma³³⁵
Poor scar outcomes <ul style="list-style-type: none"> • Younger age, wound site, higher number of deep sutures³³⁶

Australian studies

The focus and main outcomes of Australian studies on epidemiology and risk factors for poor burn outcomes are presented in Tables 6 & 7. Outcomes on burn and peri-wound assessment included that: bioimpedance spectroscopy was useful to assess oedema^{119,120} and progress in healing¹²¹; water displacement volumetry was reliable to assess postburn volume changes¹²²; total body surface area (TBSA) was more accurately assessed using an online ‘Burnschart’ compared to conventional systems¹²³; and there were significant inaccuracies in burn size estimation.¹²⁴ Two studies evaluated burn injury severity scores,^{125,126} and one the Burn Specific Health Scale-B to assess recovery¹²⁷.

Studies on psychosocial factors reported that: half of patients with burns had psychiatric, behavioural and/or drug use disorders¹²⁸; persons with intentional burns had poorer outcomes¹²⁹; psychosocial factors were associated with length of stay (Increased LOS)¹³⁰; qualitative studies explored experiences of trauma, psychosocial adjustment and impact

of burns on behavioural change re social activities¹³¹⁻¹³⁷; patient concerns¹³⁸ and depression impacted post-traumatic growth^{139,140}; Type-D personality was associated with higher psychopathology¹⁴¹; hospitalised adults with burns spent two-thirds of time alone¹⁴²; and attachment style was related to psychosocial recovery.¹⁴³

On symptom research, predictors of fatigue were: being female; having a higher TBSA; and living in non-metropolitan areas.¹⁴⁴ Studies on pain found that: severity at 3 months predicted satisfaction with pain management¹⁴⁵; the use of validated pain assessment tools enhanced assessment¹⁴⁶; and pain assessment varied considerably.¹⁴⁷ A significant relationship was found between mental health and itch,¹⁴⁸ and that younger age was a predictor of itch.¹⁴⁹ A number of tools were validated, including: a dysphagia risk model¹⁵⁰; Lower Limb Functional Index¹⁵¹; nomogram to predict quality of life (QoL)¹⁵²; Brief Fatigue Inventory¹⁵³; and Canadian Occupational Performance Measure.¹⁵⁴ On dysphagia, one study found no association between burn location and risk of dysphagia,¹⁵⁵ while another found burn area, head and neck burns, inhalation injury and ventilation were risk factors for dysphagia.¹⁵⁶

Eight studies focused on assessment of complications, including the modified Vancouver Scar Scale,^{157,158} Brisbane Burn Scar Impact Profile,¹⁵⁹ and photographic scar evaluation.¹⁶⁰ A positive troponin test was associated with cardiac complications,¹⁶¹ while burn area, ICU admission and prolonged ventilation were associated with acute coagulopathy¹⁶² and increased risk of VTE.¹⁶³ Inhalational burns were a risk factor for infection.¹⁶⁴

Worldwide reviews

Four EBGs, three evidence summaries, and 15 SRs covered assessment. The EBGs focused on acute pain¹⁶⁵ or general burn assessment.^{7,166,167} The evidence summaries focused on: clinical assessment¹⁶⁸; TBSA assessment¹⁶⁹; body image assessment¹⁷⁰; and laser doppler imaging.¹⁷¹ The SRs covered: burn microbiology; biomarkers; wound infection; measurement of burn depth or healing potential; infrared thermography; machine learning for burn assessment; and impact of burn injuries on body image or psychological outcomes.

Management

The management of burns was addressed in 192 documents – 75 Australian research studies, nine EBGs, 73 SRs, 35 evidence summaries and four consensus papers.

Australian studies

Study designs and topics are found in Tables 2 & 3, and findings on management intervention studies in Table 8.

Worldwide reviews

EBGs covered: burn management^{7,166,172-176}; non-silicone or silicone gels¹⁷⁷; management of noncomplex burns¹⁶⁷; allied

Table 5. Australian research findings on interventions to prevent surgical wound complications

Intervention / primary findings	Intervention / primary findings
<p>Skin preparation</p> <ul style="list-style-type: none"> • Higher odds of SSI from chlorhexidine-alcohol compared to iodine-alcohol³³⁷ • Reduced risk of SSI from alcoholic chlorhexidine compared to povidone-iodine³³⁸ • No difference in SSIs from chlorhexidine in ethanol vs aqueous chlorhexidine³³⁹ • No difference in SSIs from alcoholic chlorhexidine vs alcoholic povidone-iodine vs aqueous povidone-iodine³⁴⁰ • Reduced SSIs from topical decolonisation prior to Mohs surgery in adults with nasal <i>S. aureus</i>^{341,342} • No change in number of positive swabs after tinting chlorhexidine-alcohol solution³⁴³ • Inconclusive results of a trial of povidone-iodine vs saline soaked gauze³⁴⁴ 	<p>NPWT and/or wound dressing types</p> <ul style="list-style-type: none"> • No difference in SSI rates from early removal of post-operative dressing³⁶² • NPWT reduced SSIs and/or wound dehiscence in abdominal incisions^{363,364} • An evaluation of dressings resulted in a new protocol and reduced SSIs³⁶⁵ • No significant difference in SSI rates from NPWT in abdominal donor sites³⁶⁶ • No significant difference in SSI rates from NPWT in obese women following CS³⁶⁷ • No difference in SSI rates from NPWT vs routine dressings in laparotomies³⁶⁸ • No difference in healing time between NPWT and alginate-based dressings³⁶⁹ • No difference in outcomes from use of a gelatin-hemostatic matrix³⁷⁰ • No difference in outcomes from NPWT after knee arthroplasty³⁷¹
<p>Prophylactic antibiotics</p> <ul style="list-style-type: none"> • Preoperative or perioperative antibiotics reduced SSIs³⁴⁵⁻³⁴⁸ • No difference in SSIs from cephalexin prior to dermatological surgery³⁴⁹ • No difference in SSIs from gentamicin-containing collagen implants³⁵⁰ • 18% of GPs used topical antibiotics³⁵¹ • Timing and duration of antibiotic prophylaxis was associated with SSI³⁵² 	<p>Implementing EBP/ standard protocols</p> <ul style="list-style-type: none"> • Low adherence to EBP for preventing SSI in a survey of obstetricians³⁷² • Adherence to EBGs on antibiotic prophylaxis decreased rates of SSI^{373,374} • Use of infection prevention bundles had positive outcomes³⁷⁵⁻³⁷⁷ • A post-operative glycaemic control protocol reduced SSI rate³⁷⁸ • Protocols to manage external ventricular drains reduced infection³⁷⁹ • A national hand hygiene intervention had mixed results on SSIs³⁸⁰ • Ring-fencing was effective to prevent SSI³⁸¹ • An education program led to increased guideline care, however, increased SSIs³⁸²
<p>Operative techniques</p> <ul style="list-style-type: none"> • Use of staples associated with increased exudate compared to sutures³⁵³ • Sternal cables were not superior to traditional wiring to prevent SSI³⁵⁴ • Reduced SSIs from barrier retraction wound protection in colorectal surgery³⁵⁵ • Few complications from use of inferior gluteal artery myocutaneous flap³⁵⁶ • Reduced SSIs associated with use of a microbial sealant³⁵⁷ 	<p>Scar management</p> <ul style="list-style-type: none"> • No difference in scar outcomes between diathermy vs scalpel incisions³⁸³ • Higher recurrence of keloid scars with verapamil vs triamcinolone³⁸⁴ • Improved aesthetic outcome from barbed vs smooth sutures³⁸⁵
<p>Infection control apparel</p> <ul style="list-style-type: none"> • No difference in SSIs with non-sterile vs sterile gloves for minor surgery³⁵⁸ • No difference in SSIs when non-scrubbed OT staff did not wear face masks³⁵⁹ 	
<p>Wound irrigation</p> <ul style="list-style-type: none"> • No difference in SSIs from povidone-iodine irrigation prior to skin closure³⁶⁰ • Fewer SSIs from pulse irrigation vs standard irrigation before closure³⁶¹ 	

health and psychosocial management¹⁷²; burn care under austere conditions¹⁷⁸; and pain management.¹⁶⁵ Evidence summaries were on: first aid^{179–181}; non-pharmacological interventions for pain and anxiety^{182–184}; pruritus¹⁸⁵; recombinant human growth hormone¹⁸⁶; growth factors¹⁸⁷; topical treatments or dressings^{188–194}; burn surgery and grafting^{195–199}; axillary burns²⁰⁰; silver-based antiseptics²⁰¹; hydrotherapy²⁰²; blister management²⁰³; TNP²⁰⁴; health services^{205,206}; shock wave therapy²⁰⁷; nutrition^{208,209}; models of care²¹⁰; liquefied petroleum gas burns²¹¹; and cement burns.²¹² Consensus documents covered: pre-hospital management of burns²¹³; first aid clinical guidelines²¹⁴; burns care in mass casualty incidents²¹⁵; and enzymatic debridement.²¹⁶ The SRs covered first aid; symptom management; infection; advanced biological treatments; debridement; dressings and topical treatments; adherence to treatment; nutrition and skin grafts.

Prevention

One Australian study addressed the prevention of burns, a controlled, comparative study which evaluated a targeted burn prevention message on safety knowledge and behaviour in an at-risk adult population.²¹⁷ One EBG provided recommendations in the prevention of burn injuries.⁷

Mixed acute wounds

A total of 62 documents addressed mixed types of acute

Table 6. Australian research on epidemiological aspects of burns

Epidemiological aspect / main outcomes
Geographic aspects
<ul style="list-style-type: none"> • Burn rates differ relative to geography^{386,387} • Burn types differ across health service types³⁸⁸
Incidence/prevalence of burn types
<ul style="list-style-type: none"> • Burn types in hospitals have changed over time³⁸⁹ • Clothing burns have decreased over time³⁹⁰ • Incidence of flash burns³⁹¹, methamphetamine related burns³⁹², cement burns³⁹³, tap water scalds³⁹⁴, or burns involving drug or alcohol use in the home³⁹⁶
Demographic aspects
<ul style="list-style-type: none"> • Higher burn rates in males, Indigenous persons and children 0–4 years^{395,396} • Higher hospital admissions for burns in males, older adults and young children³⁹⁷ • Females and Indigenous persons found at greater risk of interpersonal violence burns³⁹⁸
Occupational aspects
<ul style="list-style-type: none"> • 17% of burns were work-related³⁹⁹ • 5.4% of burn fatalities were work-related⁴⁰⁰
Psychosocial aspects
<ul style="list-style-type: none"> • Higher burn rates in areas of greater social disadvantage⁴⁰¹ • 2.2% of admissions were found to be self-inflicted burns⁴⁰²

wounds, including four Australian studies. Study designs and topics are shown in Tables 2 & 3.

Assessment

One Australian study found chemotherapy was significantly associated with longer healing time.²¹⁸ In addition, the Wounds Australia Standards provide recommendations for wound assessment, prevention and management.²¹⁹

Table 7. Australian research on risk factors associated with poor outcomes from burns

Burn outcome/ risk factors identified
Delayed burn healing
<ul style="list-style-type: none"> • Diabetes⁴⁰³
Increased burn severity
<ul style="list-style-type: none"> • Older adults⁴⁰⁴ • Severity indicated by plasma protein C^{405,406}
Burn infection
<ul style="list-style-type: none"> • Higher TBSA^{407–409} • Prior antibiotic use⁴¹⁰ • MRSA colonisation⁴¹¹ • Longer hospitalisation^{408,411} • Nicotine, alcohol and illicit substance use⁴¹²
Longer hospital duration
<ul style="list-style-type: none"> • Diabetes, infection⁴¹³ • Full thickness burns⁴¹⁴ • Dementia⁴¹⁵ • Mental health problems⁴¹⁶ • Nicotine, alcohol, illicit substance use⁴¹² • Obesity⁴¹⁷ • Older adults³⁹⁷ • TBSA>20%³⁹⁷
Kidney complications
<ul style="list-style-type: none"> • Age, increased TBSA, surgery and cardiac comorbidity⁴¹⁸
Poor skin graft outcome
<ul style="list-style-type: none"> • LOS, operative duration⁴¹⁹
Severe inhalation injury
<ul style="list-style-type: none"> • Higher TBSA, enclosed space, face burns, hoarse voice⁴²⁰
Mortality
<ul style="list-style-type: none"> • Severe inhalation injury⁴²¹ • Nicotine, alcohol, illicit substance use⁴¹² • Obesity⁴¹⁷ • Gender/males^{397,422–424} • Age, increased FTSA, APACHE III-j score^{422–424} • No relationship between gender and survival⁴²⁵
Poor scar outcomes
<ul style="list-style-type: none"> • Fitzpatrick skin (pigmentation) type 4–6⁴²⁶ • Longer time to heal⁴²⁷ • Lower pressure pain threshold⁴²⁸

Table 8. Australian studies on management of burns

Main findings /focus	Main findings /focus
<p>First aid for burns</p> <ul style="list-style-type: none"> Increased risk of inadequate first aid in remote areas^{429,430} Adequate first aid associated with improved outcomes^{431–433} Transfer to specialist services needed within 16 hours for those with inhalation injury⁴³⁴ 	<p>Wound infection</p> <ul style="list-style-type: none"> Differences in microbiological profile found in general vs specialist hospital areas⁴⁵⁴ Low incidence of non-candidal fungal infections found in a specialist burns service⁴⁵⁵ Vancomycin clearance was significantly higher in people with burns⁴⁵⁶ Biochemical and hemodynamic changes can be early indicators of sepsis⁴⁵⁷ A cohort study found a therapeutic drug monitoring program beneficial⁴⁵⁸
<p>Pain and symptom management</p> <ul style="list-style-type: none"> Regional nerve blocks more effective than routine pain relief for donor sites⁴³⁵ 90% of patients were satisfied with 3% lidocaine emulsion spray for dressings⁴³⁶ A trial of IV lidocaine for severe burn wound care was not conclusive⁴³⁷ An axillary brachial plexus block reduced pain in comparison to routine analgesia for dressing changes⁴³⁸ Interactive gaming consoles reduced pain⁴³⁹ Pregabalin reduced neuropathic pain from burns⁴⁴⁰ A significant proportion of patients experienced long-term pain⁴⁴¹ Beeswax and herbal oil cream reduced itch compared to aqueous cream⁴⁴² Coban compression reduced oedema more than a standard compression glove⁴⁴³ 	<p>Nutrition</p> <ul style="list-style-type: none"> Nutrition, enteral feed volumes and weekly weights were found areas of need⁴⁵⁹ Post-pyloric feeding achieved higher nutrition adequacy than gastric feeding⁴⁶⁰ Thiamine supplementation appeared beneficial⁴⁶¹
<p>Wound bed treatments</p> <ul style="list-style-type: none"> Mepilex Ag[®] was found more effective than Biobrane[™], Acticoat[™] or Aquacel[®] Ag⁴⁴⁴ Early excision of devitalised tissue reduced ICU stay⁴⁴⁵ Use of Biobrane[™] led to reduced time to re-epithelialisation⁴⁴⁶ 44% of participants treated with Biobrane needed additional interventions⁴⁴⁷ Evaluation of AWBAT-S compared to Biobrane found mixed results⁴⁴⁸ A polyurethane dermal template was found safe as a dermal substitute⁴⁴⁹ 	<p>Scar management</p> <ul style="list-style-type: none"> Improvement in pain and itch found from carbon dioxide laser treatment⁴⁶² Less adherence with compression garments associated with higher sensitivity⁴²⁸ Moisturiser recommendations for burn scars⁴⁶³ Patients' and therapists' qualitative perspectives of wearing and encouraging wearing of compression garments^{464,465}
<p>Skin grafts</p> <ul style="list-style-type: none"> Less sensory function in those treated with INTEGRA1 dermal scaffold vs SSG⁴⁵⁰ Cryopreserved cadaveric skin allografts had fewer than 30% viability⁴⁵¹ CEA in combination with widely meshed SSG led to higher take rate⁴⁵² 87% of grafts with Meek technique were found to heal well⁴⁵³ 	<p>Self-management and rehabilitation</p> <ul style="list-style-type: none"> An educational DVD led to increased confidence in self-management⁴⁶⁶ A co-designed booklet was found useful and acceptable to persons with burns⁴⁶⁷ Qualitative analysis of experiences of peer support during rehabilitation⁴⁶⁸ Qualitative exploration of perspectives of recovery from severe hand burns⁴⁶⁹ Occupational therapy in the first 6 months for hand and upper limb burns⁴⁷⁰ Trial of hand therapy for partial thickness hand burns (n=29) was inconclusive⁴⁷¹ Orofacial exercise rehabilitation improved mouth opening⁴⁷²
	<p>Health services and costs</p> <ul style="list-style-type: none"> Care pathway reported for minor burn patients⁴⁷³ Inconsistent rates of compliance with EBP⁴⁷⁴ Use of VTE prophylaxis varied⁴⁷⁵ Improved EBP minimised extended preoperative fasting in major burn cases⁴⁷⁶, lessons learned on management of burns disasters⁴⁷⁷ and mortality audit results⁴⁷⁸ Cost studies included a qualitative study on out-of-pocket costs with Aboriginal families⁴⁷⁹ and a cost analysis of care for older adults with hot water burns⁴⁸⁰

Management

A total of 59 documents addressed management – two Australian research studies, two EBGs, 19 evidence summaries, 17 consensus documents and 19 SRs.

Australian studies

A report from a mixed methods study found positive evaluations of a decision tree for products and wound management²²⁰, while a survey of nurses found around half were unaware of national wound management standards, and only 35% reported good knowledge of wound products.¹²

Worldwide reviews

Guidelines included a 2011 EBG on NPWT²²¹ and national standards for wound management.²¹⁹ Evidence summaries covered: debridement^{222,223}; pain management^{224–226}; topical treatments or dressings^{227–237}; and techniques to identify infection²³⁸. Consensus documents focused on: NPWT^{239,240}; debridement²⁴¹; exudate management^{242,243}; wound infection^{244,245}; aseptic technique²⁴⁶; dressings and topical treatments^{247–253}; advanced cell, physical and IT based therapies²⁵⁴; scar management²⁵⁵; and team management.²⁵⁶ The SRs focused on: wound bed management; debridement; NPWT; wound infection; dressings/topical treatments; nutrition; and adjunct interventions.

Prevention

Three documents addressed prevention of acute wounds – the Australian Standards for Wound Management,²¹⁹ a pre/post study of a model to promote evidence-based wound prevention,²⁵⁷ and a SR on aloe vera for wound prevention.²⁵⁸

Traumatic wounds

There was a total of 42 documents on acute traumatic wounds – nine Australian studies, 28 SRs, one consensus document, three evidence summaries and one EBG. Study designs and topics are shown in Tables 2 & 3.

Assessment

Three documents addressed assessment – two Australian research studies and one SR.

Australian studies

There were two large Australian retrospective cohort studies on risk factors for obstetric perineal or anal sphincter traumatic injury. One study found ethnicity, shoulder dystocia and assisted delivery were risk factors for severe perineal tears,²⁵⁹ while the other found gestational diabetes and a macrosomic baby combined with assisted delivery were risk factors for severe perineal tears or anal sphincter injuries.²⁶⁰

Worldwide reviews

One SR was found on risk factors for severe obstetric perineal trauma.²⁶¹

Management

A total of 33 documents addressed management – six

Australian research studies, one EBG, one consensus document, two evidence summaries and 23 SRs.

Australian studies

Two retrospective studies of lower limb traumatic wounds found improved outcomes from free-flap reconstruction within 3 days of injury and immediately following fracture fixation²⁶² and significantly decreased deep infection rate in patients receiving NPWT compared to conventional dressings²⁶³. Another retrospective study found stable patients with single abdominal stab wounds could be safely managed with close observation without surgery.²⁶⁴ A descriptive study of laceration repair outcomes reported good patient satisfaction with management; however, less with follow-up advice.²⁶⁵ Studies on obstetric perineal trauma reported inconsistent health services and lack of standardised care,²⁶⁶ and a trial of straight vs curved episiotomy scissors found no differences in outcomes.²⁶⁷

Worldwide reviews

One 2011 EBG focused on NPWT for traumatic wounds and reconstructive surgery.²⁶⁸ Evidence summaries were found on the management of traumatic wounds in community settings,²⁶⁹ and the impact of shaving on perineal wound infection.²⁷⁰ A consensus document covered the risk, management and prevention of wound complications from birth injuries.²⁷¹ The SRs focused on the management of obstetric perineal trauma; preventing infection; NPWT; hyperbaric oxygen therapy (HBOT); lower extremity traumatic wounds; gunshot wounds; dog bite wounds; antiseptic solutions; haemostatic dressings; and flaps for revascularisation and soft-tissue coverage.

Prevention

Six documents addressed prevention – one Australian research study, one evidence summary and four SRs. A randomised controlled trial (RCT) found no effect from the use of a birth trainer to prevent pelvic floor trauma.²⁷² An evidence summary focused on preventing medical adhesive injury.²⁷³ The SRs covered techniques to reduce perineal trauma.

Skin tears

A total of 32 documents were identified on skin tears – 18 Australian research studies, three SRs, one EBG, two evidence summaries and eight consensus documents. Study designs and topics are shown in Tables 2 & 3.

Assessment

A total of 16 documents addressed assessment – 11 Australian studies, one evidence summary, one SR and three consensus documents.

Australian studies

Two studies on skin tear prevalence reported: prevalence of 8.9% (5.5% hospital-acquired) in a hospital setting over 10 years, decreasing over time²⁷⁴; and 58–66% over

6 months in a retrospective study in aged care facilities.²⁷⁵ On classification of skin tears, a multinational Delphi study (including Australia) of the validity and reliability of the International Skin Tear Advisory Panel classification system found moderate to high agreement, and added a definition of 'skin flap' to the system.²⁷⁶

Risk or prognostic factors for skin tears were identified in six studies: malnutrition²⁷⁷; use of heel protectors or anti-embolic stockings²⁷⁵; ecchymosis^{278,279}; skin purpura^{278–280}; haematoma²⁷⁸; history of previous skin tears^{278,280}; oedema²⁷⁸; inability to reposition independently²⁷⁸; older age²⁷⁹; lower Braden score²⁷⁹; higher risk of falling²⁷⁹; osteoporosis²⁷⁹; use of corticosteroid inhaler²⁷⁹; history of falls in the previous 3 months^{280,281}; elastosis^{280,281}; and male gender.^{280,281}

Four validity or reliability studies tested assessment tools or risk models for skin tears. A study in an aged care setting of non-invasive instruments for assessment of trans-epidermal water loss, hydration, skin thickness, elasticity, surface sebum and pH found mostly good intra-rater reliability and reproducibility with ultrasound measurements.²⁸² A prospective validation of a skin tear risk assessment tool in hospital patients found the tool did not perform well in predicting skin tears within 10 days.²⁸³ However, a risk model for skin tears developed with aged care residents resulted in an area under the receiver operating characteristic curve of 0.854, sensitivity 81.7%, and specificity 81.4%.²⁸⁰ Another study undertook a comparative analysis of predictive risk models for skin tears, finding predictive abilities ranged from AUC (Area Under the Curve) 0.67–0.85.²⁸⁴

Worldwide reviews

One SR found age-related skin changes, dehydration, malnutrition, sensory changes, mobility impairment, immunosuppressive medication, anticoagulants and mechanical factors were risk factors for occurrence of skin tears.²⁸⁵ An evidence summary was identified on skin tear assessment in community settings.²⁸⁶ Three consensus documents^{10–289} covered risk factors and assessment of skin tears.

Management

Ten documents addressed management – three Australian studies, one evidence summary, five consensus documents, and one EBG.

Australian studies

A protocol evaluation on emergency management of skin tears found a significant improvement in healing time.²⁹⁰ Two pre-post studies aimed to increase implementation of EBGs – one in an acute aged and rehabilitation setting found increased compliance to guidelines and decreased prevalence of skin tears.²⁹¹ The second in a community setting found increased uptake of best practice in most items evaluated.²⁹²

Worldwide reviews

One EBG covered management of skin tears²⁹³ and an evidence summary covered management in community settings.²⁹⁴ Consensus documents were found on: skin tear management^{10,287}; management in aged skin²⁸⁸; lower limb skin tears²⁹⁴; and dressings.²⁹⁵

Prevention

A total of 14 documents covered prevention – six Australian papers, one SR, one EBG, and six consensus documents.

Australian studies

Four studies investigated the effectiveness of skin moisturising on prevention of skin tears. A cluster RCT of twice-daily moisturising vs usual care in aged care facilities found the intervention reduced the incidence of skin tears by almost 50%²⁹⁶, while a case control study of a similar intervention in an acute care setting found decreased incidence of skin tears, however, no statistically significant differences²⁹⁷. In contrast, a case-historical control study of twice daily moisturiser application in adults ≥ 65 years in an acute setting found a significant decrease in incidence of skin tears ($p=0.006$).²⁹⁸ Evaluation of a national program to increase use of emollient moisturiser to prevent skin tears in DVA (Department of Veterans Affairs) patients found increased dispensing of emollients; however, skin tear outcomes were not reported.²⁹⁹ As noted above in the management section, two pre-post studies focused on implementation of EBGs; with regards to prevention, one in the acute aged and rehabilitation setting found decreased point prevalence of skin tears,²⁹⁰ while the second in a community setting found increased uptake of best practice; however, it did not report incidence of skin tears.²⁹¹

Worldwide reviews

A SR concluded there was inadequate evidence for recommendations on hygiene and emollients in preventing skin tears.³⁰⁰ One EBG covered prevention of skin tears.²⁹² Six consensus documents were identified on maintaining skin integrity and prevention of skin tears.^{10,288,301–303}

Discussion

This scoping review identified a consistent amount of Australian original research studies generated on acute wound care over the time of the review – with around 20 to 30 studies published each year between 2010–2022. The majority of Australian studies (90%) were focused on either burns or surgical wounds, with minimal studies on skin tears (6%) and traumatic wounds (3%). As surgery accounts for 25% of all hospital admissions³⁰⁴ and burn care also requires significant health system resources, there is a substantial impost on health service funds,³⁰⁵ thus opportunities to reduce the impact are understandably the focus for research. This includes but is not limited to continuing education to remain abreast of the latest advances in the field and appropriate policy changes to reflect updates in EBP. Interestingly, this review revealed

a paucity of research on skin tears, which is at odds with the reported prevalence of these wounds (e.g., 8.9% in an acute hospital population,²⁷⁴ 19% in aged care settings,²⁵⁷ 15–17% of wounds in community nursing setting²) and the subsequent demands on healthcare resources.

Results also demonstrate a gap in studies providing high level evidence, with small numbers of experimental or controlled study designs. Without evidence from these study types, there are limited opportunities to obtain robust findings from SRs, which themselves support development of clinical practice guidelines and policies. It is notable that an extremely large number of SRs were identified on surgical wounds in this review (n=541), in comparison to burns (n=88), traumatic wounds (n=28), acute wounds in general (n=20) and skin tears (n=3).

Most of the Australian studies were focused on wound assessment or management (97%), with only 2% on prevention,^{217,257,272,290,296,297,298,299} despite the obvious potential benefits for the population and healthcare settings and resources through preventing avoidable wound types (e.g. burns, skin tears). A gap was noted in studies conducted in primary care settings, with 78% of studies conducted in hospital settings although a large proportion of care for wounds such as burns, surgical wounds, lacerations and skin tears is provided in primary health settings, including general practice, residential aged care and home/community nursing care³. The costs of wound care in these Australian primary healthcare settings is considerable,^{2,3,61} thus an increased priority on research in primary healthcare settings is warranted to address the issue.

The identified gaps in this review, i.e., lack of research on skin tears and traumatic wounds, studies with strong research designs, studies on prevention and in studies in primary healthcare settings, provide important directions for future research. Similar gaps in studies on prevention and studies with strong research designs were found in a review on chronic wound research.³⁰⁹ It is recommended to increase the focus of Australian wound research on prevention and prioritise resources for well designed research, particularly in community and primary healthcare settings. Outcomes from this future research are needed to form the essential building blocks for development of best practice guidelines, healthcare policy and optimal clinical practice to improve outcomes in all settings.

Limitations

This scoping review was broad within its scope, resulting in a large number of documents. As such, there are limitations to be considered such as the diversity of study designs, wound types and topics of research, populations and settings. Due to the broad nature of this scoping review, a quality evaluation was not undertaken. Our search strategies, despite testing and refining, may have not identified all eligible documents on this review topic.

Conclusions

Australian research on acute wounds has remained constant over the last decade, focused primarily on burns and surgical wounds, with relatively little research on skin tears or traumatic wounds. Results indicate additional gaps in research on wound prevention and in community and primary healthcare settings, despite the high prevalence of differing acute wound types cared for in these settings.

Conflict of interest

The authors declare no conflicts of interest.

Ethics statement

An ethics statement is not applicable.

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Author contribution

All authors contributed to study design, UTB, KS-H and KF contributed to document identification and review, and KF and UTB to data analysis and synthesis. KF and UTB were responsible for manuscript preparation and all authors for feedback on the manuscript. All authors read and approved the final manuscript.

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References can be found by logging into the electronic version of the WPR Journal via the Wounds Australia website members' area (woundsaustralia.org).