Original Research

Early Paediatric Burn Wound Management in Italy: A Cross-Sectional Survey of Protocol-Driven Practices in the First 24 Hours

Citation: Nicolosi B, Rogai A, Difalco BV, Bastarelli E, Bini C, Griffa D, Minoia M, Allegri S, Lorenzo L, Stangoni M, Facchini F, Ciprandi G, Di Lonardo A. "Early Paediatric Burn Wound Management in Italy: A Cross-Sectional Survey of Protocol-Driven Practices in the First 24 Hours" (2026) *International Journal of Wound Research* 2(1): 61-75. DOI: https://doi.org/10.64115/ijwr-2026-304

Received: February 1, 2026

Revised: February 16, 2026

Just accepted: March 27, 2026

Published: March 28, 2026

Correspondence: Ariela Rogai - School of Human Health Sciences, University of Florence, Florence, Italy. Email: arielarogai2002@gmail.com

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Conflict of Interest: The author(s) declare(s) no conflict of interest.

Funding: This research received no external funding.

Biagio Nicolosi[1], Ariela Rogai[2], Benedetta Virginia Difalco[1], Eleonora Bastarelli[3], Carlotta Bini[3], Davide Griffa[4,5], Maria Minoia[6], Stefania Allegri[7], Luisa Lorenzo[8], Manuela Stangoni[9], Flavio Facchini[10], Guido Ciprandi[11], Antonio Di Lonardo[12]

[1] Nursing Assistance, Health Professions Department, Meyer Children's Hospital IRCCS, Florence, Italy
[2] Health Department, University of Florence, Florence, Italy
[3] Outsourcing and Appropriateness of Resource Use – Wound Care Team, Tuscany Centre Local Health Authority (Azienda USL Toscana Centro), Florence, Italy
[4] Burns Center and Dermatology, Romagna Local Health Authority Cesena/Forlì (AUSL Romagna Cesena/Forlì), M. Bufalini Hospital, Cesena, Italy
[5] Medicine Department and Surgery Science, University of Bologna, Bologna, Italy
[6] Burns Center, Plastic Surgery and Burn Center, Brindisi Local Health Authority (ASL Brindisi), "A. Pirrino" Hospital of Brindisi, Brindisi, Italy
[7] Rehabilitation Medicine, Geriatric Rehabilitation Medical Department, AOU Parma "Ospedale Maggiore", Parma, Italy
[8] Burns Center, Plastic Surgery and Burn Center, AOU Parma "Ospedale Maggiore", Parma, Italy
[9] Burns and Plastic Surgery Center, Emergency Department Admission, "Villa Scassi" Hospital, Genoa, Italy
[10] Burns and Plastic Surgery Center, Surgery Department, Meyer Children's Hospital, Florence, Italy
[11] Complex Unit of Plastic Surgery, University of Padua, Padua, Italy
[12] Burns Center, Emergency Department Admission, AOU Pisana, Pisa, Italy

Abstract

Introduction. Early management of paediatric burn wounds is a critical determinant of wound progression, healing time, and long-term outcomes. The first 24 hours after injury represent a dynamic phase in which clinical decisions regarding cleansing,

antisepsis, dressing selection, and follow-up may influence burn wound conversion and complications. Despite available guidelines, early paediatric burn care remains heterogeneous, and real-world data describing institutional practices are limited.

Methods. A cross-sectional observational survey was conducted to describe early paediatric burn wound management practices in Italian burn centres. A structured, evidence-informed questionnaire was distributed electronically to designated clinical referents from 17 centres managing paediatric burns. Respondents were asked to report protocol-driven, centre-level practices regarding first aid, wound cleansing and antisepsis, initial dressing selection according to burn depth, timing of first reassessment, and caregiver education. Data were collected between May and June 2025 and analysed using descriptive statistics.

Results. Eleven professionals participated, predominantly nurses (90.9%), most of whom worked in major burn centres. Cooling with running water for 20 minutes was the most frequently reported first-aid measure across burn aetiologies (90.9%). Wound cleansing was performed in all centres, most commonly using normal saline (63.6%). Antisepsis was frequently adopted, particularly for flame burns (100%), with 0.05% sodium hypochlorite being the most commonly reported agent. Paraffin-impregnated gauze was the preferred dressing for first-degree (81.8%) and superficial partial-thickness burns (72.7%). For deep partial-thickness and small full-thickness burns (<5 cm), collagenase, silver alginate, and hydrogel were more frequently selected. First wound reassessment occurred within 24 hours in 63.6% of centres. Most respondents (81.8%) reported providing structured caregiver education focused on home dressing management and pain control.

Discussion and Conclusions. Early paediatric burn wound management practices in Italian burn centres appear broadly aligned with current first-aid and early reassessment recommendations. However, variability in antiseptic use and dressing selection persists, particularly for deeper burns, highlighting the need for shared, depth- and objective-driven frameworks to support early clinical decision-making and future multicentre consensus initiatives.

Keywords: Paediatric Burns, Wound Care, Burn Dressings, First Aid Practices, Cooling

Introduction

Why paediatric burns matter

A burn is defined as an anatomical injury caused by the action of thermal, chemical, electrical, or radiation energy, leading to tissue damage of variable depth and extent.[1] According to estimates from the World Health Organization, burns are responsible for approximately 180,000 deaths each year worldwide, with many more non-fatal injuries associated with prolonged hospitalisation, functional impairment, and psychosocial consequences.[2] Beyond their acute clinical severity, burn injuries may result in long-lasting effects on physical function, body image,

and quality of life, particularly when scarring or contractures occur.[3]

In the paediatric population, burn injuries pose unique clinical and organisational challenges. Children differ from adults in terms of skin structure, body surface area distribution, metabolic response to injury, and immunological maturity, all of which may influence burn depth progression, infection risk, and healing trajectories.[4,5] Furthermore, the impact of burn injuries in childhood extends beyond the acute phase, potentially affecting growth, development, and psychosocial wellbeing. As a result, paediatric burn care requires specialised expertise and an integrated multidisciplinary approach that addresses not only wound healing but also pain control, family involvement, and continuity of care.[6,7]

The initial management of burn wounds plays a crucial role in determining outcomes, particularly during the first 24 hours after injury.[8] This early phase is characterised by rapid pathophysiological changes at both the wound and systemic levels, during which inappropriate or delayed interventions may contribute to burn wound conversion, increased infection risk, prolonged healing time, and suboptimal scarring. Key clinical decisions made at presentation—including wound cleansing, antisepsis, blister management, and the selection of topical or advanced dressings—can therefore substantially influence both short- and long-term outcomes. In paediatric settings, these decisions are further complicated by the need to minimise pain and distress, preserve fragile periwound skin, and actively involve caregivers in the care process.[9,10]

What is known and unknown about early management

Despite advances in wound care technologies and the increasing availability of topical and advanced dressings, no universally accepted gold standard exists for the early management of paediatric burn wounds. Clinical practice is therefore often guided by local protocols, clinician experience, and resource availability, resulting in substantial inter-centre variability in antisepsis strategies, dressing selection, and procedural approaches during the first 24 hours.[11,12] This heterogeneity reflects both the intrinsic complexity of burn care and the limited availability of real-world data describing how early management is implemented in routine clinical practice.[13,14]

Beyond in-hospital care, variability also extends to the pre-hospital phase. Recent evidence suggests that the adequacy of burn first aid is influenced not only by knowledge and access to information, but also by socioeconomic factors and health inequalities. Socioeconomic deprivation has been associated with a higher likelihood of inadequate first aid practices and the use of potentially harmful home remedies, highlighting the need for targeted public health interventions.[14,15]

In recent years, increasing attention has been directed towards the optimisation and standardisation of early burn wound management, with the aim of reducing complications, improving healing trajectories, and enhancing patient and family experience.[16,17] However, despite the availability of guidelines and expert recommendations, there remains a lack of detailed, context-specific data describing how early burn wound management is operationalised in everyday clinical practice, particularly in the paediatric population and during the first 24 hours after admission. Descriptive studies mapping current practices are therefore essential to identify prevailing trends, highlight areas of variability, and provide a foundation for future comparative research and quality improvement initiatives.[8,18,19]

Why mapping practices in Italy is needed now

In a protocol-driven healthcare system such as the Italian one, where only a limited number of centres are formally recognised as paediatric burn centres but many institutions manage paediatric burns, mapping current practices is particularly relevant. Describing how early burn wound management is operationalised at the centre level may help distinguish acceptable practice variability from areas of potential clinical inappropriateness and provide a foundation for future harmonisation efforts.

Aim and objectives

Within this framework, the present cross-sectional study was designed to describe the initial management of paediatric burn wounds in Italian centres, with a specific focus on topical and advanced dressings used within the first 24 hours after admission. Secondary objectives

included documenting the use of antiseptics in association with dressings, wound cleansing practices and solutions, timing of the first clinical re-evaluation, and the presence of structured follow-up pathways aimed at ensuring continuity of care. Selected descriptive variables, including respondents' professional role and years of experience in paediatric burn care, were also collected to explore potential factors associated with the observed clinical practices.

Methods

Study design

To address this requirement, an observational cross-sectional survey study was conducted to describe early wound management practices in children with burns. This design was chosen to capture real-world clinical practices at a specific point in time without interfering with routine care processes, in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies.[20]

Setting and population

The study targeted Italian burn centres that provide care for paediatric patients. Eligible centres were identified among those officially recognised by the Italian Society of Burns (Società Italiana Ustioni – SIUST) as burn care facilities. The list of invited centres corresponded to the national SIUST-recognised burn centres reporting paediatric activity at the time of the study. Although only two centres in Italy are formally recognised as paediatric burn centres (Meyer Children's Hospital in Florence and Santobono Hospital in Naples), all recognised burn centres that also manage paediatric burn patients were considered eligible.

The survey was addressed to healthcare professionals directly involved in the initial management of paediatric burn injuries, including nurses, physicians, and surgeons working in emergency departments, burn units, inpatient wards, or outpatient clinics.

Sampling strategy

A purposive sampling strategy was used to recruit centre-level clinical referents with recognised operational responsibility in paediatric burn care. Each participating burn centre nominated one designated referent, identified internally on the basis of locally acknowledged seniority, competence, and direct involvement in protocol-driven burn management and service organisation. Importantly, referents were selected primarily as institutional representatives responsible for reporting their centre's standardised procedures, rather than as individual informants providing personal opinions or preferences.

Seventeen Italian burn centres reporting paediatric activity were invited to participate in the survey; of these, eleven centres completed the questionnaire, resulting in a centre-level response rate of 64.7%. One questionnaire was completed per centre. Each completed questionnaire represents the centre's standard early-management pathway as documented in institutional protocols and standard operating procedures, rather than individual clinicians' preferences.

The survey was distributed to the nominated referents, and data were collected between May and June 2025. Respondents were instructed to complete the questionnaire using their centre's formal written protocols, standard operating procedures (SOPs), and established clinical pathways as the primary reference framework, in order to capture routine practice as formally implemented at the institutional level. Where applicable, referents were encouraged to cross-check responses against locally approved documentation and multidisciplinary agreements to minimise subjective interpretation, reduce individual-reporting bias, and enhance inter-centre comparability of reported practices.

The predominance of nurses among respondents reflects their designation within participating centres as operational referents for protocol-based burn wound management. This distribution should not be interpreted as an indication of greater clinical expertise compared to physicians or surgeons; rather, it reflects organisational role allocation and the routine involvement of nursing staff in the implementation and coordination of early burn care pathways at the institutional level.

Data collection tool

Data were collected using a structured, ad hoc

questionnaire developed for the purpose of the study and administered electronically via Google Forms®. Questionnaire items were developed following an evidence-informed approach, drawing on the main domains consistently reported in the literature and international recommendations on early burn wound management (e.g., cooling, cleansing, antisepsis, dressing selection, and timing of reassessment). The draft version was then refined through expert review by three clinicians with expertise in paediatric burn care to ensure clarity, relevance, and content appropriateness. Formal psychometric validation of the instrument was not performed, given the descriptive aim of the study. The full questionnaire, including all items and response options, is provided as Supplementary Material 1 to enhance transparency and reproducibility.

The questionnaire consisted of two main sections: 1) General information, including professional role (nurse, physician, surgeon), years of experience in paediatric burn care (<1 year, 1–3 years, 3-5 years, 5-10 years, >10 years), and primary clinical setting (emergency department, burn centre, inpatient ward, outpatient clinic); 2) Initial burn management, structured according to burn aetiology (scalds, flame burns, chemical burns), reflecting the need to differentiate early treatment strategies based on injury mechanism. For each aetiological category, respondents were asked about: initial first aid measures performed by caregivers prior to hospital access; wound cleansing practices and solutions used; use of antiseptic agents and type of antiseptic employed.

Blister deroofing was intentionally not included as a closed-ended question in this section due to the lack of international consensus on blister management and its high operator-dependent variability. This choice aimed to maintain focus on more standardised and comparable practices, such as cooling, cleansing, antisepsis, and dressing selection.

Subsequently, respondents were asked to indicate dressing choices according to burn depth (superficial erythema, superficial partial-thickness, deep partial-thickness, and full-thickness burns with a diameter <5 cm), selecting from a predefined list of topical and advanced dressings commonly used in clinical practice.

Burn depth categories were intentionally grouped to reflect clinically distinct management scenarios. Superficial and partial-thickness burns were considered representative of conservative early wound management pathways, primarily aimed at epithelial preservation, pain control, and prevention of burn wound conversion. In contrast, full-thickness burns, even when limited in size (<5 cm), were considered a separate clinical entity, characterised by different therapeutic objectives, organisational pathways, and potential surgical implications.

Additional questions explored aspects of continuity of care, irrespective of burn aetiology or depth, including timing of first wound reassessment (<24 h, 24 h, 24-48 h, >48 h), provision of caregiver education for home management, and the presence of structured outpatient or home-based follow-up pathways.

Study outcomes

The primary outcome was the type of topical or advanced dressing used within the first 24 hours after admission for paediatric burn patients. Secondary outcomes included the use of antiseptics in association with dressings, performance of wound cleansing and type of cleansing solution used, modalities and timing of first clinical reassessment, and the presence of structured follow-up pathways to ensure continuity of care. Descriptive variables related to respondents' professional role and years of experience were collected to explore potential factors associated with observed practices.

Data management and statistical analysis

Survey responses were collected anonymously and exported into Microsoft Excel for analysis. Data were analysed using descriptive statistics. Categorical variables were summarised as frequencies and percentages, while continuous variables were described using means where appropriate. No inferential statistical analyses were performed, given the descriptive nature of the study.

Ethical considerations

The study did not involve the collection of patient-level clinical data or identifiable personal information and therefore did not require approval from an ethics committee. Participation was voluntary and anonymous, and informed consent was obtained electronically at the beginning of the survey.

All data were collected and stored in compliance with the General Data Protection Regulation (GDPR; EU Regulation 2016/679). No identifying information, e-mail addresses, or IP data were collected. Data were analysed and reported in aggregated form only and stored securely on a protected institutional Google Drive accessible solely to the research team. Data will be retained for a maximum of five years for methodological verification purposes and subsequently securely deleted.

Results

Questionnaire responses were collected between 17 June and 4 July 2025, with the participation of 11 professionals identified as key contacts from Italian major burn centers. Since some questions allowed multiple answers, the sum of percentages may exceed 100%.

In the section describing participant characteristics, almost all respondents were nurses (10/11; 90.9%), while 1/11 (9.1%) was a physician. Work experience in burn care was mainly between 5 and 10 years (36.4%), followed by 3-5 years (27.3%) and ≤3 years (18.2%); smaller groups included professionals with >10 years of experience (9.1%) and an additional subgroup accounting for 9.1%. Regarding clinical setting, 9/11 (90.9%) worked in a major burn center, while 3/11 (27.3%) worked in an outpatient clinic, 2/11 (18.2%) in an inpatient ward, and 1/11 (9.1%) in the emergency department (Tables 1-3).

Initial approach according to the burn agent

For scald burns, the most frequently reported initial treatment performed by caregivers before arrival at the healthcare facility was cooling with water for 20 minutes (10/11; 90.9%). The application of medicated products (e.g., gauzes, creams, sprays containing active ingredients) was reported in 2/11 (18.2%), while 1/11 (9.1%) reported no treatment. No participants reported the use of non-medicated products (e.g., toothpaste or moisturizers). Wound cleansing

Table 1. Data are presented as n/N (%), where n represents the number of responding centres and N the total sample (N = 11). Multiple clinical settings could be selected; therefore, percentages may exceed 100%. Each questionnaire reflects the centre's standard early-management pathway as defined by institutional protocols and standard operating procedures (SOPs).

Centre referent characteristics		
Inclusion criteria	**Variables**	**n/N (%)**
Respondent profile	Profession - Nurse	10/11 (90.9)
	Profession - Physician	1/11 (9.1)
	Experience ≤3 years	2/11 (18.2)
	Experience 3-5 years	3/11 (27.3)
	Experience 5-10 years	4/11 (36.4)
	Experience >10 years	1/11 (9.1)
	Other/unspecified subgroup	1/11 (9.1)
Clinical setting*	Major burn center	9/11 (90.9)
	Outpatient clinic	3/11 (27.3)
	Inpatient ward	2/11 (18.2)
	Emergency department	1/11 (9.1)

Table 2. Data are presented as n/N (%), where n represents the number of centres reporting the practice and N the total number of responding centres. PHMB = polyhexamethylene biguanide. Multiple responses were allowed; therefore, percentages may exceed 100%. The reported range for 0.05% sodium hypochlorite (6/11–7/11) reflects differences across burn types.

Early management by burn agent		
Domain	**Variables**	**n/N (%)**
Initial management by burn agent	Scald burns - Cooling 20 min	10/11 (90.9)
	Scald burns - Antisepsis performed	9/11 (81.8)
	Flame burns - Cooling 20 min	8/11 (72.7)
	Flame burns - Antisepsis performed	11/11 (100)
	Chemical burns - Cooling 20 min	9/11 (81.8)
	Chemical burns - Antisepsis performed	7/11 (63.6)
Most frequently selected antiseptics**	0.05% sodium hypochlorite	6/11-7/11 (54.5-63.6)
	Polyhexamethylene biguanide (PHMB)	4/11 (36.4)
	2% chlorhexidine	1/11 (9.1)

Table 3. Values are expressed as n/N (%), where n indicates the number of centres reporting the dressing and N the total number of responding centres. NaOCl = sodium hypochlorite (0.05%). Full-thickness burns were limited to lesions <5 cm in diameter. Multiple selections were permitted.

Advanced dressings by burn depth		
Domain	**Variables**	**n/N (%)**
Advanced dressings by burn depth**	First-degree burns - Paraffin-impregnated gauze	9/11 (81.8)
	First-degree burns - NaOCl 0.05% dressing for 24h	3/11 (27.3)
	First-degree burns - Hydrogel	2/11 (18.2)
	Superficial second-degree burns - Paraffin-impregnated	8/11 (72.7)
	Superficial second-degree burns - Hydrocolloids	4/11 (36.4)
	Superficial second-degree burns - NaOCl 0.05% dressing for 24h	3/11 (27.3)
	Deep second-degree burns - Collagenase	6/11 (54.5)
	Deep second-degree burns - Silver alginate	5/11 (45.5)
	Deep second-degree burns - Hydrogel	5/11 (45.5)
	Third-degree burns (<5 cm) - Paraffin-impregnated	5/11 (45.5)
	Third-degree burns (<5 cm) - Silver alginate	4/11 (36.4)
	Third-degree burns (<5 cm) - Collagenase	4/11 (36.4)

was performed by 11/11 (100%), mainly using normal saline (7/11; 63.6%) and sterile water (6/11; 54.5%); tap water was reported in 3/11 (27.3%), and lactated Ringer's solution in 1/11 (9.1%). Antisepsis was carried out by 9/11 (81.8%) of professionals, most commonly using 0.05% sodium hypochlorite (6/11; 54.5%) and polyhexamethylene biguanide (PHMB) (4/11; 36.4%); 2% chlorhexidine was reported in 1/11 (9.1%), while povidone-iodine and hypochlorous acid were not selected by any participant.

For flame burns, cooling with water for 20 minutes was indicated in 8/11 (72.7%) of cases, while medicated products were applied in 2/11 (18.2%); 1/11 (9.1%) reported no treatment. Cleansing was performed in 11/11 (100%) of cases, using normal saline (6/11; 54.5%), sterile water (6/11; 54.5%), and tap water (3/11; 27.3%). Antisepsis was performed by all respondents (11/11; 100%), primarily using 0.05% sodium hypochlorite (7/11; 63.6%), followed by PHMB (4/11; 36.4%) and 2% chlorhexidine (1/11; 9.1%).

For chemical burns, cooling with water for 20 minutes was reported by 9/11 (81.8%) of participants, while 2/11 (18.2%) indicated the use of medicated products. Cleansing was performed in 9/11 (81.8%) of cases, mainly with normal saline (7/11; 63.6%), sterile water (5/11; 45.5%), and less frequently tap water (1/11; 9.1%); in 2/11 (18.2%), cleansing was not performed. Antisepsis was reported by 7/11 (63.6%), whereas 4/11 (36.4%) did not perform antisepsis. The most commonly used agent was 0.05% sodium hypochlorite (6/11; 54.5%), followed by PHMB (4/11; 36.4%) and 2% chlorhexidine (1/11; 9.1%) (Figure 1A-B).

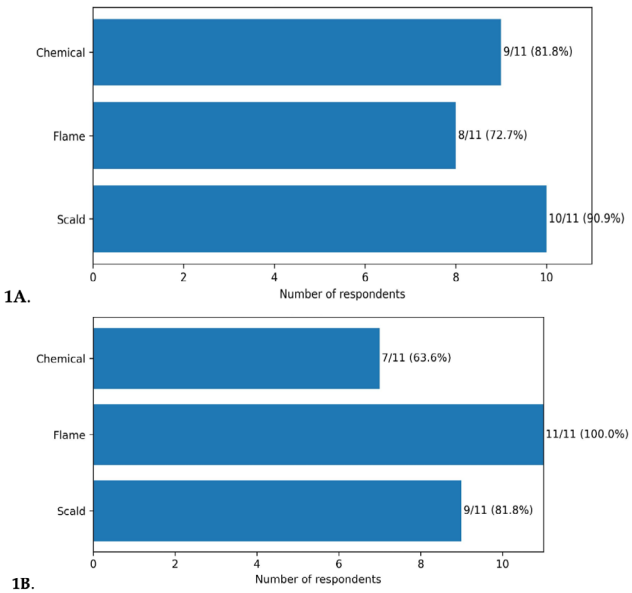

Figure 1. A) Reported use of cooling with water for 20 minutes before arrival at the healthcare facility, stratified by burn agent (n = 11). B) Reported performance of wound antisepsis in the initial management phase, stratified by burn agent (n = 11).

Advanced dressings according to burn depth

The stratification of dressing choices by burn depth highlighted both expected depth-driven

patterns and areas of overlap across depth categories, suggesting potential inconsistencies in the conceptual separation of conservative versus definitive wound management strategies.

Regarding advanced dressings selected by burn depth, for first-degree burns a clear preference emerged for paraffin-impregnated/medicated gauze (9/11; 81.8%). Additional treatments, reported less frequently, included a 0.05% sodium hypochlorite dressing for 24 hours (3/11; 27.3%) and hydrogel (2/11; 18.2%), whereas silver alginate and hydrocolloids were indicated only marginally (1/11; 9.1% each) (Figure 2A).

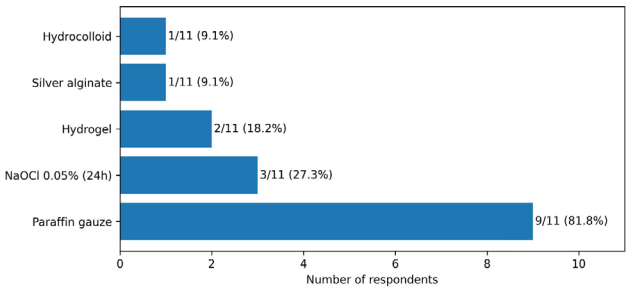

Figure 2A. Advanced dressings reported for the initial management of first-degree burns (n = 11).

For superficial second-degree burns, the most frequently selected dressings remained paraffin-impregnated/medicated gauze (8/11; 72.7%), followed by hydrocolloids (4/11; 36.4%) and a 0.05% sodium hypochlorite dressing for 24 hours (3/11; 27.3%). Silver foam, silver alginate, collagenase, alginogel, and dialkylcarbamoyl chloride (DACC) were each reported in 1/11 (9.1%) of cases, while hydrogel was not selected (Figure 2B).

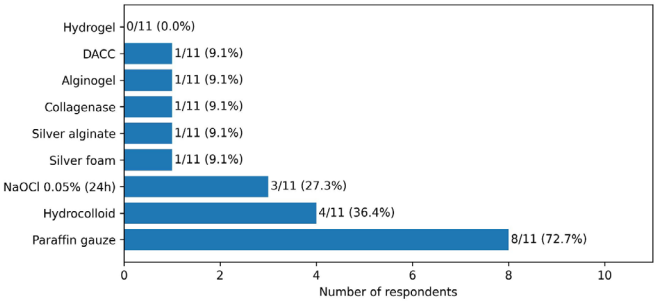

Figure 2B. Advanced dressings reported for the initial management of superficial second-degree burns (n = 11).

For deep second-degree burns, the most frequently reported dressing was collagenase (6/11; 54.5%), followed by silver alginate (5/11; 45.5%) and hydrogel (5/11; 45.5%). Paraffin-impregnated/medicated gauze was indicated by 4/11 (36.4%), hydrocolloids by 3/11 (27.3%), while silver foam and alginogel were selected in 2/11 (18.2%); DACC and a 0.05% sodium hypochlorite dressing were each reported in 1/11 (9.1%) (Figure 2C).

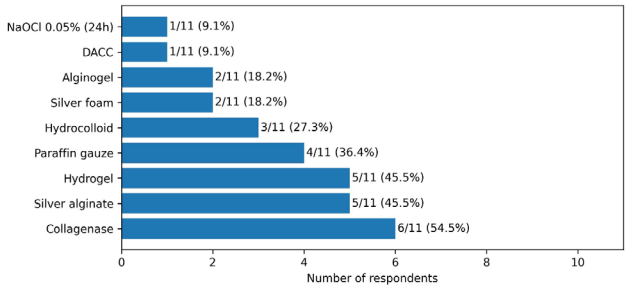

Figure 2C. Advanced dressings reported for the initial management of deep second-degree burns (n = 11).

For third-degree burns with a diameter <5 cm, paraffin-impregnated/medicated gauze represented the most frequent choice (5/11; 45.5%), followed by silver alginate and collagenase (4/11; 36.4% each). Hydrogel and a 0.05% sodium hypochlorite dressing were selected in 3/11 (27.3%), while silver foam, hydrocolloids, alginogel, and DACC appeared in 1/11 (9.1%) of cases each (Figure 2D).

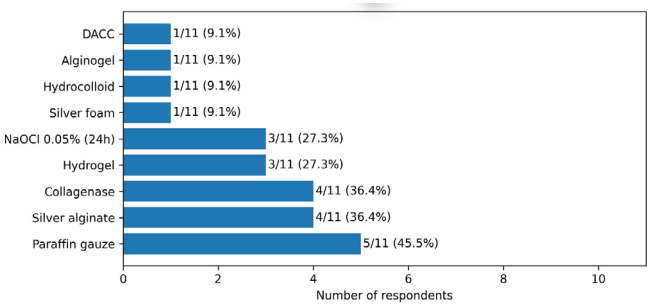

Figure 2D. Advanced dressings reported for the initial management of third-degree burns with a diameter <5 cm (n = 11).

Reassessment and caregiver education

The first wound reassessment was carried out within 24 hours in 7/11 (63.6%) of cases. Reassessments performed before 24 hours and between 24-48 hours were less frequent, both reported in 2/11 (18.2%) (Figure 3).

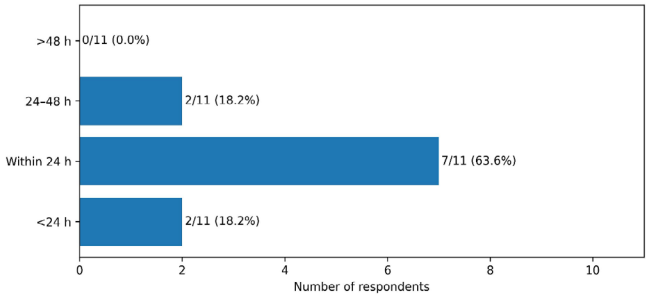

Figure 3. Timing of first wound reassessment following the initial burn management (n = 11).

Most participants (9/11; 81.8%) reported providing caregivers with home management education, while 2/11 (18.2%) reported providing education only in selected cases (Figure 4).

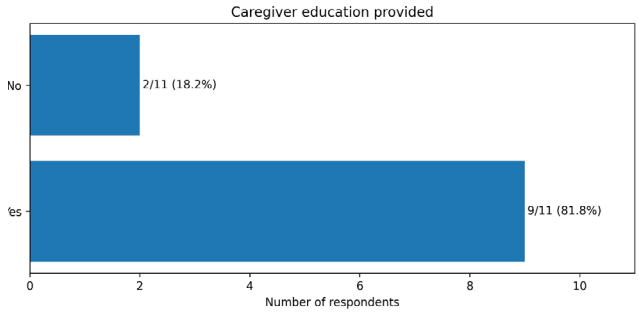

Figure 4. Proportion of respondents reporting provision of home management education to caregivers (n = 11).

Open-text responses indicated that caregiver education most frequently addressed three main domains: dressing management at home (including instructions on how to perform the dressing change while maintaining asepsis and ensuring dressing adherence), pain control, and recognition of warning signs suggestive of infection or dressing intolerance. Less frequently reported topics included scar management and prevention of adverse scarring outcomes, recommendations on skin care (e.g., hydration and sun protection), and advice on appropriate clothing or fabric selection (Supplementary table 1).

Key findings

Cooling with water for 20 minutes was reported across all burn aetiologies. Antisepsis was reported in 9/11 (81.8%) for scald burns, 11/11 (100%) for flame burns, and 7/11 (63.6%) for chemical burns. Paraffin-impregnated gauze was the most frequently reported dressing for first-degree and superficial second-degree burns, whereas collagenase, silver alginate, and hydrogel were more frequently reported for deep second-degree and small third-degree burns (<5 cm).

For selected variables, not all participants provided complete responses; therefore, totals may not correspond to the overall sample size due to missing data and/or multiple-answer options.

Discussion

This cross-sectional survey provides a snapshot of early paediatric burn wound management practices reported by key professionals from Italian major burn centres, with a predominant contribution from nurses. The findings highlight the central role of nursing staff across the burn care pathway, including wound assessment, dressing selection, pain monitoring, early re-evaluation, and caregiver education. The contribution of professionals with intermediate-to-advanced burn-care experience may further support the reliability of the reported practices and reflects the relevance of expertise in this clinical field.[21]

From an interpretative perspective, the variability observed across centres should not be read exclusively as a consequence of differences in resource availability or institutional procurement policies. Rather, the reported practices appear to reflect heterogeneous treatment philosophies and decision-making approaches adopted in the early phase of paediatric burn care.

While a certain degree of variability may be clinically acceptable in the absence of high-quality comparative evidence, the use of similar dressing strategies across markedly different burn depths and clinical objectives raises concerns regarding potential clinical inappropriateness. In this sense, the findings of the present study suggest that even within expert settings, early burn wound management may not always be fully aligned with depth-driven and goal-oriented principles of care.

Importantly, the aim of the present study was not to rank or recommend specific products, but to highlight patterns of use that may warrant further reflection and critical appraisal.

By documenting how advanced dressings are selected in routine practice, the study provides a framework for distinguishing between acceptable practice variability and areas

where harmonisation based on shared clinical principles may be required.

First aid and early wound management

Across burn aetiologies, cooling with water for 20 minutes emerged as the most frequently reported first-aid measure prior to healthcare access, particularly for scald burns. This pattern is consistent with European and UK guidance that recommends 20 minutes of cool running water as the cornerstone of early burn first aid, while avoiding hypothermia risk in children.[22–24] Evidence also supports a clinically meaningful benefit when cooling is performed within the first hours after injury, with improved outcomes reported in contemporary studies.[25] In addition, recent paediatric evidence suggests that adequate cooling – defined as 20 minutes of cool running water applied within 3 hours of injury – may translate into clinically relevant reductions in burn severity and surgical escalation. In a large cohort study including 2,495 children, adequate cooling was independently associated with a lower likelihood of skin grafting (OR 0.6; 95% CI 0.4–0.8), reduced odds of full-thickness injury depth (OR 0.4; 95% CI 0.2–0.6), and fewer operating room interventions (OR 0.7; 95% CI 0.5–0.9).[23] Collectively, these findings suggest that effective pre-hospital cooling may reduce burn severity and the need for surgical intervention when consistently applied. Notably, respondents did not report the use of non-medical or potentially harmful substances, suggesting appropriate first-aid behaviours within the observed context.[22] However, a minority of respondents reported that caregivers applied medicated products before presentation, and in a small proportion no pre-hospital intervention was performed, suggesting residual variability in first-aid behaviours despite the absence of harmful home remedies.

In line with previous observational evidence, disparities in the adequacy of initial burn first aid remain a relevant issue. Socioeconomic deprivation has been reported to be inversely associated with adequate first aid, with deprived groups more frequently adopting inappropriate or harmful practices. These findings reinforce the importance of structured first-aid education and standardized pathways.[15]

In the subsequent phase of care, cleansing with normal saline was widely reported, in line with evidence supporting burn wound cleansing as a clinically relevant practice aimed at removing contaminants while minimising additional tissue injury.[26] Sterile water and tap water were also reported as cleansing solutions, while lactated Ringer's solution was selected only occasionally. This may reflect differences in local availability, Emergency Department workflows, and protocol preferences across centres.[27] Antisepsis showed variability across burn agents, being consistently reported for flame burns, frequently for scald injuries, and less frequently for chemical burns. This pattern is clinically plausible, as early chemical burn management prioritises removal of the offending agent through irrigation and decontamination strategies, while topical applications may be delayed or avoided depending on exposure and tissue status.[28]

Among antiseptics, 0.05% sodium hypochlorite was the most commonly reported option, followed by PHMB, while chlorhexidine was rarely selected. Although antiseptic use remains heterogeneous in burn care, available evidence supports the role of topical antiseptics in selected scenarios to reduce microbial burden, while balancing tolerability and potential cytotoxicity.[29,30]

Dressing selection and depth-driven patterns

A key finding of this survey concerns the depth-driven selection of advanced dressings. Paraffin-impregnated gauzes were most frequently reported for first-degree and superficial partial-thickness burns, reflecting the common preference for non-adherent and practical dressings in routine clinical practice.[14] Interestingly, paraffin-impregnated gauze was also frequently reported for small full-thickness burns (<5 cm), indicating that its use may extend beyond superficial injuries in selected scenarios. Hydrocolloids were also commonly selected for superficial partial-thickness burns, suggesting a preference in some centres for occlusive dressings in low-to-moderate exudate scenarios. In addition, a 0.05% sodium hypochlorite–based dressing applied for 24 hours was reported across multiple depth categories, indicating that some centres integrate antiseptic dressings into early topical management rather than limiting antiseptics to cleansing alone. In deeper lesions, respondents more frequently selected collagenase, silver alginate, and hydrogel. Collagenase use in deep partial-thickness burns is consistent with its role in enzymatic debridement

strategies; however, evidence also highlights the need to consider its lack of intrinsic antimicrobial activity, potentially requiring combination with antimicrobial dressings or antiseptic approaches when clinically indicated.[31]

Less frequently reported categories – such as DACC, alginogel, and silver foams – may reflect selective indications, variable familiarity among professionals, and differences in local formularies and procurement policies. These findings reinforce the presence of heterogeneity in the adoption of advanced technologies, even within major centres.[32–36]

An important finding emerging from this survey is the partial overlap in dressing selection between superficial/partial-thickness burns and small full-thickness burns. While this may partly reflect pragmatic or transitional approaches, it also suggests a potential lack of conceptual separation between conservative early wound management and lesions that inherently represent a different clinical and organisational scenario. In paediatric burn care, first- and second-degree burns are typically managed with the primary aim of promoting spontaneous re-epithelialisation and minimising distress, whereas third-degree burns, even when limited in size, are associated with different prognostic trajectories, surgical considerations, medico-legal implications, and follow-up needs. The observed overlap in dressing choices may therefore reflect a cultural rather than resource-driven variability, highlighting an area where shared conceptual frameworks and depth-specific guidance may be particularly valuable.

This variability should therefore be interpreted in light of category-level reporting, which reflects shared treatment philosophies rather than specific product-level decisions.

Clinical appropriateness and practice variability

The variability observed in the selection of topical and advanced dressings across centres should be interpreted not only as heterogeneity of practice, but also through the lens of clinical appropriateness.[14,37] In early paediatric burn care, it is essential to distinguish between acceptable variability and critical variability. Acceptable variability refers to the use of different, evidence-informed dressing options that are clinically equivalent and coherent with burn depth, wound phase, and therapeutic objective (e.g., protection, moisture balance, or exudate control).

Conversely, critical variability may emerge when dressing choices are not aligned with key clinical determinants, such as burn depth, stage of wound evolution, or the primary treatment goal. Examples include the use of non-antimicrobial or purely protective dressings in clinical contexts requiring bioburden control, or the application of occlusive dressings in wounds where active debridement or close monitoring is indicated. In these cases, variability may reflect differences in local clinical culture, individual treatment philosophy, or experiential habits rather than evidence-based decision-making.[14,37]

The present findings suggest that early dressing selection is influenced not only by product availability or procurement pathways, but also by educational and philosophical approaches to burn care. This underscores the need for shared, depth-driven and goal-oriented frameworks to support clinical appropriateness in early paediatric burn management, rather than prescriptive, product-centred recommendations.

Reassessment and continuity of care

Most respondents reported performing the first wound reassessment within 24 hours. Early reassessment is clinically relevant in paediatric burns due to the risk of burn wound conversion and the need to refine depth assessment, detect complications, and adjust dressing strategies.[38] Caregiver education was widely reported and focused primarily on home dressing management (including aseptic handling and dressing adherence), pain control, and recognition of warning signs suggestive of infection or dressing intolerance. However, a small proportion of respondents reported providing caregiver education only in selected cases. Less frequently, caregivers received guidance on scar management and prevention, skin care recommendations (hydration and sun protection), and clothing/fabric selection – elements that may be particularly relevant for long-term outcomes and quality of life in paediatric burn survivors.[39–41]

Beyond acute management, caregiver education represents a key component of early burn care, particularly when considering that inequalities in health literacy and access to correct information may influence first aid behaviours and early wound management decisions.[15]

Implications

The study suggests that early paediatric burn care practices reported by Italian major centres are broadly aligned with the evidence supporting cool running water first aid and early follow-up.[23,24] At the same time, the observed heterogeneity in antiseptic use and advanced dressing selection – particularly for deeper burns – highlights opportunities for harmonisation through shared protocols, structured training, and multicentre research evaluating comparative outcomes.

Taken together, these findings support the need for standardized, evidence-informed early burn care pathways, while recognizing that community-level determinants may still drive variability in first aid practices and early decision-making.[15]

Limitations

This study has several limitations. First, the sample size was small and based on purposive sampling of designated centre referents, which may limit generalisability to all Italian burn services. Second, although referents were instructed to complete the survey using their centre's written protocols, standard operating procedures (SOPs), and approved clinical pathways in order to minimise subjective interpretation, responses still reflect reported institutional routines rather than direct observation of real-world clinical behaviour. Therefore, a degree of reporting bias, variability in protocol implementation, or differences in local documentation awareness cannot be fully excluded.

Third, the study design did not include patient-level variables (e.g., TBSA, burn location, age, comorbidities) or clinical outcomes (e.g., time to re-epithelialisation, infection rates, grafting requirements, pain scores, or scarring), preventing any comparative effectiveness evaluation across approaches. Finally, some survey items allowed multiple answers and not all participants responded to all questions; therefore, totals may not always correspond to the overall sample size.

An additional limitation relates to the level of detail at which topical and advanced dressings were reported.

In order to maximise feasibility and inter-centre comparability, dressing choices were collected using broad product categories (e.g. hydrogel, alginate, hydrofibre, paraffin-impregnated gauze). However, these categories encompass heterogeneous formulations that may differ substantially in terms of chemical composition, vehicle, antimicrobial properties, mode of application (e.g. gel, spray, solution, sheet), wear time, and cost.

As a result, the present analysis does not allow a fine-grained assessment of clinical appropriateness, cost-effectiveness, or equivalence between products within the same category, and the reported variability should be interpreted at a conceptual rather than product-specific level.

Future studies should integrate protocol-based surveys with prospective audits, direct observational methods, and patient-level outcome data in order to assess implementation fidelity and to evaluate the clinical impact of different early burn management approaches across centres.

Future research should explore pre-hospital first aid behaviours and the determinants of inappropriate practices, including socioeconomic deprivation and health literacy, to support targeted educational strategies and reduce avoidable burn morbidity.

Implications for practice and research

From a clinical perspective, the findings support reinforcing evidence-based first aid for paediatric burns, particularly cool running water for approximately 20 minutes delivered as early as possible after injury.[22,23] In addition, early reassessment within 24 hours appears consistently adopted and should remain a key standard to detect burn progression and tailor treatment promptly.[37]

At the same time, variability in antiseptic use and in advanced dressing selection – especially for deeper burns – suggests a need for shared, depth-driven protocols and targeted education on product selection, indications, monitoring criteria, and de-escalation strategies.[13,29,30] From a research perspective, these findings provide a foundation for multicentre comparative studies investigating outcomes associated with early management strategies, including healing time, pain burden, infection and burn conversion, need for operative intervention, and long-term scarring.[22,23] Future studies should also explore determinants of practice variation (e.g., dressing availability, procurement pathways, local

protocols, training), and assess the feasibility of a harmonised national framework for paediatric burn wound care.

Beyond describing current practices, the variability observed in early paediatric burn wound management highlights the need for a structured, shared framework to support clinical decision-making across centres. Rather than focusing on individual commercial products, future efforts should aim to develop a national consensus document based on burn depth, primary clinical objectives (e.g., protection, debridement, bioburden control), and temporal phases of care within the first 24 hours. Such a framework could help distinguish acceptable practice variability from potentially inappropriate dressing selection, support education and training, and promote greater harmonisation of early burn care pathways across Italian centres.

Beyond its descriptive value, this study should be interpreted as a preparatory step toward the development of shared principles for early paediatric burn wound management. The observed heterogeneity in dressing selection, particularly across different burn depths, highlights the need for a structured, multidisciplinary reflection aimed at defining common standards of appropriateness rather than product-driven recommendations.

In this context, maintaining a clear conceptual distinction between conservative management of first- and second-degree burns and the early handling of full-thickness injuries appears particularly relevant. Harmonised, depth-driven frameworks may help reduce culturally driven variability in dressing selection and support more consistent decision-making across centres.

Conclusions

This cross-sectional survey describes current practices in the early management of paediatric burn wounds across Italian centres, highlighting both shared approaches and substantial variability in the selection of topical and advanced dressings within the first 24 hours after admission.

While several practices appear broadly aligned with available evidence and international recommendations, the observed heterogeneity—particularly across different burn depths—suggests that early burn wound management is often guided by centre-specific treatment philosophies rather than by shared, depth-driven principles of care.

Importantly, this study does not aim to identify a single optimal treatment strategy or to promote specific products.

Rather, its value lies in mapping real-world clinical decision-making and in identifying areas where variability may reflect potential clinical inappropriateness rather than acceptable flexibility.

The use of similar dressing strategies across distinct burn depths and clinical objectives underscores the need for greater conceptual clarity in early paediatric burn wound management.

Taken together, these findings support the need for a structured, multidisciplinary effort to move beyond purely descriptive data toward the development of shared standards of appropriateness.

The present study should therefore be regarded as a foundational step for future multicentre initiatives aimed at producing a consensus-based document of good clinical practice, capable of supporting early decision-making while respecting contextual and organisational differences between centres.

References

1. Subrata SA. A concept analysis of burn care in nursing. *Scand J Caring Sci.* 2021;35(1):75-85. https://doi.org/10.1111/scs.12847
2. World Health Organization. *Burns.* Geneva: WHO; 2024 [cited 2026 Jan 17]. Available from: https://www.who.int/news-room/fact-sheets/detail/burns
3. Moi AL, Haugsmyr E, Heisterkamp H. Long-term study of health and quality of life after burn injury. *Ann Burns Fire Disasters*. 2016;29(4):295–299.
4. Giusti F, Martella A, Bertoni L, Seidenari S. Skin barrier, hydration, and pH of the skin of infants under 2 years of age. *Pediatr Dermatol.* 2001;18(2):93–96. 10.1046/j.1525-1470.2001.018002093.x
5. Nicolosi B, Parente E, Fontani I, Idrizaj S, Stringi D, Bamonte C, et al. Risk factors for skin injuries in hospitalized children: a retrospective study. *Infermieristica J.* 2024;3(4):277–285. https://doi.org/10.36253/if-3159
6. Patel KF, Rodríguez-Mercedes SL, Grant GG, Rencken CA, Kinney EM, Austen A, et al. Physical, psychological, and social outcomes in pediatric burn survivors aged 5 to 18 years: a systematic review. *J Burn Care Res.* 2022;43(2):343–352. https://doi.org/10.1093/jbcr/irab225
7. De Sousa A. Psychological aspects of paediatric burns: a clinical review. *Ann Burns Fire Disasters.* 2010;23(3):155–159.
8. Alharbi Z, Piatkowski A, Dembinski R, Reckort S, Grieb G, Kauczok J, et al. Treatment of burns in the first 24 hours: a simple and practical guide by answering 10 questions in a step-by-step form. *World J Emerg Surg.* 2012;7:13. https://doi.org/10.1186/1749-7922-7-13
9. Palackic A, Jay JW, Duggan RP, Branski LK, Wolf SE, Ansari N, et al. Therapeutic strategies to reduce burn wound conversion. *Medicina (Kaunas).* 2022;58(7):922. https://doi.org/10.3390/medicina58070922
10. Rowan MP, Cancio LC, Elster EA, Burmeister DM, Rose LF, Natesan S, et al. Burn wound healing and treatment: review and advancements. *Crit Care.* 2015;19:243. https://doi.org/10.1186/s13054-015-0961-2
11. Nicolosi B, García-Molina P, Veggi S, Pinzauti E, Pancani S. Oxygen-enriched oleic matrix medical dressings for the treatment of extensive burns and related acute and post-burn complications in children: a case series. *Wounds UK.* 2024;20(4):46–51
12. Resch A, Staud C, Radtke C. Nanocellulose-based wound dressing for conservative wound management in children with second-degree burns. *Int Wound J.* 2021;18(4):478–486. https://doi.org/10.1111/iwj.13548
13. Nischwitz SP, Luze H, Popp D, Winter R, Draschl A, Schellnegger M, et al. Global burn care and the ideal burn dressing reloaded: a survey of global experts. *Burns.* 2021;47(7):1665–1674. https://doi.org/10.1016/j.burns.2021.02.008
14. Selig HF, Lumenta DB, Giretzlehner M, Jeschke MG, Upton D, Kamolz LP. The properties of an "ideal" burn wound dressing: what do we need in daily clinical practice? Results of a worldwide online survey among burn care specialists. *Burns.* 2012;38(7):960–966. https://doi.org/10.1016/j.burns.2012.04.007
15. Kong MH, Baldwin AJ, Kerstein R. The impact of socioeconomic deprivation on the adequacy of burn first aid: a retrospective cohort study. *Burns.* 2026;52(2):107864. https://doi.org/10.1016/j.burns.2026.107864
16. Neriamparambil AJ, Sawhney R, Wong WL. Evidence-based management of burns: a narrative review of evolving practices. *Eur Burn J.* 2025;6(4):59. https://doi.org/10.3390/ebj6040059
17. Brychta P. *European practice guidelines for burn care: minimum level of burn care provision in Europe.* In: Jeschke MG, Kamolz LP, Sjöberg F, Wolf SE, editors. Handbook of Burns. Vienna: Springer; 2012. p. 97–102. https://doi.org/10.1007/978-3-7091-0348-7_6
18. van de Warenburg MS, Teeuwen B, Hummelink S, Ulrich DJ, Vehmeijer-Heeman ML. Does the dressing matter in pediatric partial-thickness burns: a systematic review and meta-analysis. *Burns.* 2025;51(4):107428. https://doi.org/10.1016/j.burns.2025.107428
19. Anderson DI, Fordyce EM, Vrouwe SQ. The quality of survey research in burn care: a systematic review. *Burns.* 2022;48(8):1825–1835. https://doi.org/10.1016/j.burns.2022.01.009
20. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *J Clin Epidemiol.* 2008;61(4):344–349. https://doi.org/10.1016/S0140-6736(07)61602-X
21. Bettencourt AP, McHugh MD, Sloane DM, Aiken LH. Nurse staffing, the clinical work environment, and burn patient mortality. *J Burn Care Res.* 2020;41(4):796–802. https://doi.org/10.1093/jbcr/iraa061
22. Stiles K, Goodwin N. *British Burn Association first aid clinical practice guidelines.* London: British Burn Association; 2020.
23. Griffin B, Cabilan CJ, Ayoub B, Xu HG, Palmieri T, Kimble R, et al. The effect of 20 minutes of cool running water first aid within three hours of thermal burn injury on patient outcomes: a systematic review and meta-analysis. *Australas Emerg Care.* 2022;25(4):367–376. https://doi.org/10.1016/j.auec.2022.05.004
24. Griffin BR, Frear CC, Babl F, Oakley E, Kimble RM. Cool running water first aid decreases skin grafting

requirements in pediatric burns: a cohort study of 2495 children. *Ann Emerg Med.* 2020;75(1):75–85. https://doi.org/10.1016/j.annemergmed.2019.06.028
25. Holbert MD, Singer Y, Palmieri T, Rose J, Mackey K, Singh S, et al. Cool running water as a first aid treatment for burn injuries. *Ann Emerg Med.* 2026;87(1):90–102. https://doi.org/10.1016/j.annemergmed.2025.08.003
26. Hayek S, El Khatib A, Atiyeh B. Burn wound cleansing: a myth or a scientific practice. *Ann Burns Fire Disasters.* 2010;23(1):19–24.
27. Carter JE, Amani H, Carter D, Foster KN, Griswold JA, Hickerson WL, et al. Evaluating real-world national and regional trends in definitive closure in U.S. burn care: a survey of U.S. burn centers. *J Burn Care Res.* 2021;43(1):141–148. https://doi.org/10.1093/jbcr/irab151
28. Chai H, Chaudhari N, Kornhaber R, Cuttle L, Fear M, Wood F, et al. Chemical burn to the skin: a systematic review of first aid impacts on clinical outcomes. *Burns.* 2022;48(7):1527–1543. https://doi.org/10.1016/j.burns.2022.05.006
29. Scalise A. The new formulation of the 0.05% sodium hypochlorite electrolytic solution for cutaneous use: reasons and advantages. *AboutOpen.* 2021;8(1):14–22. https://doi.org/10.33393/ao.2021.2221
30. Slaviero L, Avruscio G, Vindigni V, Tocco-Tussardi I. Antiseptics for burns: a review of the evidence. *Ann Burns Fire Disasters.* 2018;31(3):198–203.
31. Pham CH, Collier ZJ, Fang M, Howell A, Gillenwater TJ. The role of collagenase ointment in acute burns: a systematic review and meta-analysis. *J Wound Care.* 2019;28(Suppl 2):S9–S15. https://doi.org/10.12968/jowc.2019.28.Sup2.S9
32. Jeyaraman M, Jeyaraman N, Ramasubramanian S, Nallakumarasamy A, Murugan S, Jayakumar T, et al. Efficacy of dialkylcarbamoylchloride (DACC)-impregnated dressings in surgical wound management: a review. *Eur Burn J.* 2025;6(1):1. https://doi.org/10.3390/ebj6010001
33. Nicolosi B, Parente E. Use of antimicrobial dialkyl carbamoyl chloride (DACC) surface dressings for the treatment of infected post-surgical complications in neonates with low risk of adverse reactions: a case series in the AOU Meyer NICU. *Infermieristica J.* 2023;2(1):39–45. https://doi.org/10.36253/if-2105
34. Khundkar R, Malic C, Burge T. Use of Acticoat dressings in burns: what is the evidence? *Burns.* 2010;36(6):751–758. https://doi.org/10.1016/j.burns.2009.04.008
35. Wasiak J, Cleland H, Campbell F. Dressings for superficial and partial thickness burns. *Cochrane Database Syst Rev.* 2008;(4):CD002106. https://doi.org/10.1002/14651858.CD002106.pub4
36. Douglas HE, Wood F. Burns dressings. *Aust Fam Physician.* 2017;46(3):94–97. https://www.racgp.org.au/afp/2017/march/burns-dressings/
37. Jeschke MG, van Baar ME, Choudhry MA, Chung KK, Gibran NS, Logsetty S. *Burn injury. Nat Rev Dis Primers.* 2020;6(1):11. https://doi.org/10.1038/s41572-020-0145-5
38. Ciornei B, David VL, Popescu D, Boia ES. Pain management in pediatric burns: a review of the science behind it. *Glob Health Epidemiol Genom.* 2023;2023:9950870. https://doi.org/10.1155/2023/9950870
39. Haruta A, Mandell SP. Assessment and management of acute burn injuries. *Phys Med Rehabil Clin N Am.* 2023;34(4):701–716. https://doi.org/10.1016/j.pmr.2023.06.019
40. Chen Y, Cai T, Le P, Zhang L, Chen Y, Wu L, et al. Family caregivers' perceptions and challenges in the care of pressure injuries in daily life: a qualitative study. *BMC Geriatr.* 2025;25:490. https://doi.org/10.1186/s12877-025-06114-1