

Research Article

Paediatric Lower Extremity Burns in Bangladesh: Incidence and Outcome

Riffat Chowdhury^{1,*} , Mohammad Sadiqul Amin² ,
Mohammad Mazharul Haque¹ , Iqbal Ahmed³ 

¹Department of Plastic and Reconstructive Surgery, Dhaka Medical College and Hospital, Dhaka, Bangladesh

²Department of Orthopaedic Surgery, Gopalganj Medical College, Gopalganj, Bangladesh

³Department of Plastic and Reconstructive Surgery, Dinajpur Medical College, Dinajpur, Bangladesh

Abstract

Introduction: Pediatric lower extremity burns pose a significant challenge due to their impact on physical function, aesthetics, and quality of life. This study aims to assess the incidence, severity, management approaches, and outcomes of lower limb burns in children within the context of Bangladesh. **Methods:** This prospective observational study was conducted in the Department of Burn and Plastic Surgery, Dhaka Medical College Hospital, Dhaka, Bangladesh, from January 2021 to October 2022. In this study, a total of 40 pediatric patients with lower extremity burns were analyzed. **Result:** The most affected age group was 5–8 years (35%), with a higher prevalence in females (62.5%). Scald burns were the most common cause (35%), followed by flame burns (30%). Superficial partial-thickness burns were the most frequent (37.5%). Surgical intervention was required in 47.5% of cases, predominantly for flame and ash burns. Common surgical procedures included wound excision, scar release, and skin grafting. Delayed hospital admission beyond five days occurred in nearly half of the cases. Functional outcomes varied, with full range of motion achieved in 50% of patients and full functionality restored in 25%. Surgical cases had a higher incidence of hypertrophic scarring and limited functionality. **Conclusion:** Pediatric lower extremity burns require a multifaceted approach, with early intervention crucial in reducing complications. Delayed admissions contribute to worse outcomes, highlighting the need for improved burn awareness and timely medical intervention.

Keywords

Lower Extremity Burns, Children, Incidence, Bangladesh

1. Introduction

Burns are a significant public health concern worldwide, particularly in developing countries, due to their high morbidity and long-term disability rates [1]. Each year, approximately 238,000 deaths occur globally as a result of fire-related burns, with 95% of these fatalities happening in low- and

middle-income countries [2]. Even in developed nations, burns remain a leading cause of unintentional injury-related deaths and disabilities [3–6]. Children are especially vulnerable to burn injuries due to their limited awareness of danger and inability to react quickly and appropriately [7]. In Bang-

*Corresponding author: sakichowdhury@hotmail.com (Riffat Chowdhury)

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ladesh, childhood burns are a major public health issue. A recent study estimated that around 173,000 children in the country suffer moderate to severe burns annually [8]. The prevalence of pediatric burns also varies across different age groups, from infancy to adolescence [9].

Pediatric burns are injuries to the skin or other tissue as a result of exposure to heat (e.g., hot liquids [scalds], hot solids [contact burns], smoke [inhalation injury], or direct flames), ultraviolet/infrared radiation, radioactive materials, electricity, friction, chemicals, or cold [10]. Although less common, burns can also result from friction due to a resistive force generated by 2 surfaces moving against one another. This interaction results in the build-up of heat and physical deformation that subsequently causes a combination of thermal burn and mechanical injury most commonly occurring due to road traffic accidents [11]. In Bangladesh, Ash burns especially those involving lower extremities are a great concern as they usually cause deep burns requiring surgery. injuries affecting the lower extremities, especially foot and leg can be full-thickness in nature, requiring surgical intervention, such as debridement and/or skin grafting, and may also need flap coverage. If left untreated, these injuries can lead to infection and scar contracture, resulting in further morbidity and the potential need for surgical intervention.

The lower extremities constitute more than one-third of the entire body surface area (39% in children). After a burn injury, the need for early reconstruction of the lower extremity is based on the amount and depth of tissue destroyed. Of special consideration in the pediatric patient is the continued growth of the patient, making planning for future conditions mandatory. Delayed reconstruction may be required in patients with burn scar contracture of the hip, knee, ankle, or toes or burn scar carcinoma [11].

Reconstructing the lower extremities in pediatric burn patients is often challenging, requiring multiple surgeries over an extended recovery period. The primary goal for surgeons is to prevent burn scar deformities, which can be achieved through rapid wound closure, addressing tissue shortages, and ensuring proper postoperative care with splinting and compression therapy. The first and most critical step in burn management is prioritizing reconstructive needs. Studies show that over one-third of children with major burns develop contractures before leaving the hospital, highlighting the need for early intervention during the acute phase of treatment [12].

In addition to the risk of contractures and physical limitations, burn injuries can have lasting psychological and social impacts. The burn was found to be the most devastating cause of all childhood injuries [13, 14]. It affects mental functions, self-care, mobility, domestic life, relationships, education, and work status [15]. Long-term impairment and disability due to scarring are common in a burn [11], and psychological impairments like anxiety, post-traumatic stress disorder (PTSD), confessed depression and juvenile delinquency are not uncommon [16, 17].

The severity of a burn injury and its long-term outcomes are

largely determined by the depth of the burn and the total body surface area (TBSA) affected. Children who suffer from ash burns, flame burns, tar burns, or electrical burns tend to have a poorer prognosis. Interestingly, younger children with burn injuries often report a better quality of life compared to older children. Strong social support is a key factor in recovery, with well-established family relationships playing the most significant role in psychological adjustment. Therefore, it is crucial to identify and closely monitor patients who may have strained or compromised relationships to ensure better long-term outcomes [18].

In this study, we aimed to determine the incidence and evaluate the outcome of paediatric lower extremity burns in Bangladesh.

2. Methodology & Materials

This prospective observational study was conducted in the Department of Burn and Plastic Surgery, Dhaka Medical College Hospital, Dhaka, Bangladesh, from January 2021 to October 2022. In this study, we included 40 paediatric patients with burns involving the lower extremity within the study period.

Modified Vancouver Scar Scale	
Pliability	0 Normal
	1 Supple
	2 Yielding
	3 Firm
	4 Adherent
Height	0 Normal
	1 1~2 mm
	2 3~4 mm
	3 5~6 mm
	4 >6 mm
Vascularity	0 Normal
	1 Pink
	2 Red
	3 Purple
Pigmentation	0 Normal
	1 Slightly
	2 Moderately
	3 Severely
Assessment of the postoperative scar	
Assessment Modified Vancouver Scar Scale	
Excellent	Pliability 0, Height 0, Vascularity 0 and Pigmentation 0
Good	Pliability 0, Height 0 and Vascularity 0~1 or Pigmentation 0~1
Moderate	Pliability 0 or Height 0 and Vascularity 0~2 or Pigmentation 0~2
Hypertrophied	Pliability 0~1 or Height 0~1 and Vascularity 0~2 or Pigmentation 0~2
Keloid	Pliability 1~3 or Height 1~2 and

Figure 1. Modified Vancouver scar scale assessment.

These are the following criteria to be eligible for enrollment as our study participants: a) Paediatric patients aged up to 14 years; b) Patients with burns involving the lower extremity; c) Parents who were willing to let their children participate were included in the study And a) Patients with any other carcinoma; b) Patients with Coagulopathy; c) Patients with any history of acute illness (e.g., renal or pancreatic diseases, ischemic heart disease, asthma, COPD etc.) were excluded from our study.



Figure 2. A): 20% ash burns both lower limbs, B) 6 months follow up picture (3 stages STSG done).



Figure 3. A): Flexion contracture of all toes released and FTSG done, B) 6 months follow-up picture (3 stages done).



B

Figure 4. (A & B): Chemical burn (immediate and 8th post-burn day).

Data Collection and Analysis: All data were recorded systematically in preformed data collection form. Quantitative data was expressed as mean and standard deviation; qualitative data was expressed as frequency distribution and percentage. Data on age, gender, burn type, severity, treatment approach, and outcomes were collected. Both surgical and non-surgical management strategies were assessed, including dressing materials, surgical interventions, healing progression, and functional recovery. The data were analyzed using the SPSS (Statistical Package for Social Sciences) for Windows version 10.

3. Results

Table 1. Baseline Characteristics of our Study Subjects (n=40).

Baseline Characteristics	Frequency (n)	Percentage (%)
Age range		
6 month-2y	11	4.4%
2y-5y	7	17.5%
5y-8y	14	35%
8y-11y	4	10%
11y-14y	4	10%
Sex		
Male	15	37.5%
Female	25	62.5%
Causes of burn		
Scald	14	35
Ash burn	5	12.5
Flame burn	12	30
Electrical burn	3	7.5
Tar burn	2	5
Chemical Burn	2	5
Friction Burn	2	5
Depth of burn		

Baseline Characteristics	Frequency (n)	Percentage (%)
Superficial partial thickness	15	37.5
Deep partial thickness	9	22.5
Deep	7	17.5
Mixed	9	22.5
Side affected		
Right	16	40
Left	13	32.5
Both	11	27.5
Location of defect		
Flexor	16	40
Extensor	13	32.5
Both	11	27.5

The study included 40 pediatric patients with burn injuries. The age distribution showed that the majority of cases (35%) were between 5 to 8 years old, followed by 6 months to 2 years (27.5%), while the least affected age groups were 8 to 11 years and 11 to 14 years (10% each). Females accounted for a higher proportion of cases (62.5%) compared to males (37.5%). Among all patients, scald injuries were the most common (35%), followed by flame burns (30%). Less frequent causes included ash burns (12.5%), electrical burns (7.5%), tar burns (5%), chemical burns (5%), and friction burns (5%). The depth of burns varied among patients, with superficial partial-thickness burns being the most common (37.5%), followed by deep partial-thickness (22.5%), mixed-depth burns (22.5%), and deep burns (17.5%). Burn injuries affected different sides of the body, with 40% involving the right side, 32.5% the left side, and 27.5% affecting both sides. In terms of location, flexor surfaces were most commonly involved (40%), followed by extensor surfaces (32.5%), and both flexor and extensor surfaces in 27.5% of cases.

Table 2. Distribution of children by the dressing materials used.

Dressing material	Frequency	Percentage (%)
Silcream	8	20
Hydrocolloid + gypsonet & povidone Iodine ointment	7	17.5
Gypsonet & povidone Iodine ointment	10	25
Silcream + Gypsonet & povidone Iodine ointment	5	12.5
Hydrocolloid	6	15
Hypochlorous acid solution(Mizouh)	2	5
Alginate+ absorbent gel (Flaminol)	2	5

Table 2 shows that various dressing materials were used for burn management among the study subjects. The most frequently used material was Gypsonet combined with povidone-iodine ointment (25%). Silcream was used in 20% of cases, while hydrocolloid combined with Gypsonet and povidone-iodine ointment was used in 17.5%. Other dressing materials included hydrocolloid alone (15%), Silcream combined with Gypsonet and povidone-iodine ointment (12.5%), and hypochlorous acid solution (5%). Alginate with absorbent gel (Flaminol) was also used in 5% of cases.

Table 3. Distribution of pediatric patients by surgery needed or not.

Surgery	Frequency	Percentage (%)
Needed	19	47.5

Surgery	Frequency	Percentage (%)
Not needed	21	52.5
Burns that needed surgery		
Ash burn	5	12.5
Flame burn	7	17.5
Tar burn	2	5
Scald	3	7.5
Friction burns	2	5

Table 3 shows that surgical intervention was required in 47.5% of pediatric burn cases, while 52.5% were managed without surgery. Among those who needed surgery, flame burns accounted for the highest percentage (17.5%), followed by ash

burns (12.5%). Scald injuries required surgery in 7.5% of cases, while tar burns and friction burns each accounted for 5% of surgical cases.

Table 4. Type of surgery needed for different causes of burn.

Cause of burn	Wound excision	Scar release	Primary closure	Split-thickness skin graft	Full-thickness skin graft	Total procedure
Ash burn	5	3	1	5	2	16
Flame burn	7	2	1	4	2	16
Tar burn	2	1	1	2	nil	6
Scald	3	nil	nil	3	nil	6
Friction burn	2	nil	nil	2	nil	4

Table 4 shows that different types of surgical interventions were performed based on the cause of burns. The most common procedures included wound excision, scar release, primary closure, split-thickness skin grafts, and full-thickness skin grafts. Ash burns and flame burns required the most extensive surgical interventions, with 16 procedures each. Both required multiple wound excisions (5 for ash burns and 7 for flame burns) and skin grafts. Tar burns and scald injuries

generally required fewer procedures, with 6 surgeries each, primarily involving wound excision and split-thickness skin grafting. Friction burns had the fewest surgical interventions, with 4 procedures in total, mainly consisting of wound excision and skin grafting. Full-thickness skin grafting was mainly required for ash and flame burns, while scalds and friction burns did not require this procedure.

Table 5. Distribution of the study subjects by the gap in days between burn and hospital admission.

The gap in days between burn and hospital admission	Frequency	Percentage (%)
Same day	11	27.5
1 day	7	17.5
2 days	2	5
3 days	3	7.5
5 days	4	10
7 days	3	7.5
8 days	4	20
11 days	1	2.5
14 days	2	5
30 days	3	7.5

Table 5 shows that 27.5% of patients were admitted on the same day as their burn injury, while 17.5% were admitted within one day. On the contrary, 20% of patients were admitted after 8 days, 7.5% after 30 days, and smaller percentages at 11 and 14 days (2.5% and 5%, respectively). Delayed admissions (beyond five days) accounted for nearly half of the cases.

The study assessed the outcomes of 40 pediatric burn patients, with 19 undergoing surgery and 21 managed non-surgically. No contracture was observed in 15 patients, the majority (11) from the nonsurgical group. Minimal contracture was found in 14 patients, and severe contracture was seen in 11 cases. Good scar quality was noted in 14 patients. Hypertrophic scarring occurred in 9 patients, more commonly

in those who had surgery (6). Hyperpigmentation was reported in 7 patients. Full ROM was achieved in 20 patients, with slightly better results in the nonsurgical group (12 vs. 8). Full functionality was restored in 10 patients, with 6 in the nonsurgical group and 4 in the surgical group. Limited functionality was observed in 15 patients, predominantly in those who underwent surgery (10).

Table 6. Outcomes after Surgical and Nonsurgical Management (3-6 month).

Patient Outcomes	All	Surgical	Nonsurgical
Total patients	40	19	21
Scar contracture			
None	15	4	11
Minimal	14	10	4
Severe	11	11	Nil

Patient Outcomes	All	Surgical	Nonsurgical
Scar quality			
Good	14	2	12
Hypertrophic	9	6	3
Hyperpigmented	7	3	4
Immature	11	4	7
ROM			
Full	20	8	12
Limited	10	5	5
Unknown	10	5	5
Functionality			
Full	10	4	6
Limited	15	10	5
Unknown	15	5	10

Table 7. Distribution of pediatric patients by type of burn during follow-up.

Type of burn	Total patients	Surgery needed	2 weeks	4 weeks	6 weeks	Surgery not needed	2 weeks	4 weeks	6 weeks
Scald	14	3	5	8	3	11	10	2	nil
Ash burn	5	5	4	5	2				
Flame burn	12	7	5	7	8	5	4	3	3
Electric burn	3	nil	nil	nil		3	3	2	nil
Tar burn	2	2	1	2	1	nil			
Chemical burn	2	nil	nil	nil	nil	2	2	1	1
Friction burn	2	2	2	1					

Table 8. Modified Vancouver scar scale.

Type of burn	Surgery needed	Surgery not needed	Parameter	Description	Points	Score in no. of surgical pts(3)	Score in nonsurgical pts(11)	Total points in surgical pts	Total points in nonsurgical pts
Scald(14)	3	11	pigmentation	Normal	0	nil	8	2	1
				hypopigmented	1	nil	3		
				hyperpigmented	2	3	nil		
			vascularity	Normal	0	nil	8	1	3
				Pink	1	1	2		
				Red	2	nil	1		
				Purple	3	2	nil		

Type of burn	Surgery needed	Surgery not needed	Parameter	Description	Points	Score in no. of surgical pts(3)	Score in nonsurgical pts(11)	Total points in surgical pts	Total points in nonsurgical pts
			pliability	Normal	0	nil	8	0	7
				Supple	1	nil	nil		
				Yielding	2	nil	nil		
				Firm	3	2	nil		
				Banding	4	1	nil		
				Contracture	5	nil	nil		
			Height	Normal(flat)	0	nil	8	0	3
				>0 and <2 mm	1	2	nil		
				>2mm and<5mm	2	1	nil		
				>5 mm	3	nil	nil		

Table 7 shows the healing outcomes for different types of burns over 6 weeks, comparing patients who required surgery versus those who healed without surgical intervention. All 5 patients with ash burns required surgery. Healing progress was seen in 4 patients by 2 weeks, with all 5 showing improvement by 4 weeks. Scald and flame burns were the most common types of burns. Most scald burns healed without surgery, while flame burns often required surgical intervention. Electrical and chemical burns did not require surgery, with most patients healing within 2 to 4 weeks. Tar and friction burns often needed surgery and required a longer recovery period.

points) to contracture (5 points), indicating increasing stiffness and restriction. Surgical cases showed a higher presence of firm and banding scars, suggesting greater skin tightness. Surgical patients tended to have thicker scars compared to non-surgical cases.

Figure 5 illustrates the 48 surgical procedures performed on 19 pediatric burn patients. These included scar release (6 cases), wound excision (17 cases), primary closure (3 cases), full-thickness skin grafting (4 cases), and split-thickness skin grafting (18 cases).

4. Discussion

Lower extremity burns in pediatric patients, though less common than upper extremity burns, can be equally severe, especially in cases of mixed or deep burns. Without timely and appropriate management—whether through dressings or surgical intervention—serious complications can arise. Our study found that children aged 5–8 years were most at risk, likely due to increased independence, outdoor activities, and access to hazardous items like matches.

Burn injuries in children can have long-term physical, psychological, and socioeconomic consequences. In Bangladesh, more than two-thirds of childhood burn victims experience varying degrees of physical impairment, requiring assistance with daily activities for durations ranging from one week to six months. This is significantly higher than in Ghana, where only 17% of burn-injured children suffer from physical impairments [19]. The disparity may be attributed to differences in healthcare-seeking behavior, as parents in rural Bangladesh often seek treatment from traditional healers, local medicine shopkeepers, or unqualified providers due to limited access to specialized burn care.

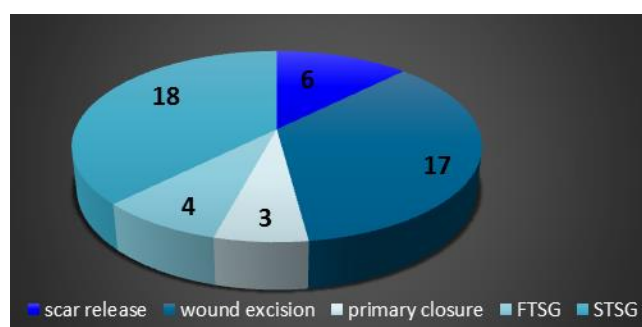


Figure 5. Distribution of pediatric patients by procedures.

Table 8 shows the comparison between scald burn patients who required surgery and those who did not, based on different burn parameters. Among non-surgical patients, most had normal pigmentation, while surgical patients had higher occurrences of hyperpigmentation. Surgical patients had higher scores in vascularity due to increased redness or purple discoloration. Pliability is measured on a scale from normal (0

Education is also significantly affected by burn injuries. Our study found an average school absence of 25 days, consistent with previous research [20, 21]. However, when considering only hospitalized burn cases, school loss was much higher, averaging 48.28 days. Among working children, the average work loss was 25 days a much lower figure than reported in the USA [22]. This discrepancy may be due to differences in study design—the present study included a broad range of burn severities in a community-based setting, whereas the US study focused exclusively on patients treated in healthcare facilities.

The initial management of burns varied widely. Many families first sought treatment from traditional healers, local dispensaries, or used home remedies such as animal grease or medicinal plant powders [23-26]. In one study, 77.9% of patients initially received care at non-specialist centers, with only 22.1% receiving proper burn treatment from a plastic surgeon. Delays in receiving specialist care and poor compliance with splinting therapy were common [27]. Early burn wound excision for deep burns was rarely practiced, with only one study mentioning that two out of 79 pediatric patients with hand burn contractures had received early excision and grafting, though outcomes were not specified [28].

We performed 48 surgical procedures on 19 patients, including scar release (n=6), wound excision (n=17), primary closure (n=3), full-thickness skin grafting (n=4), and split-thickness skin grafting (n=18). However, we faced several challenges, such as loss to follow-up (often after the first visit), poor compliance with splinting and physiotherapy, and long gaps between follow-ups. Dressing materials varied based on wound condition, with Silcream commonly used for deep and mixed burns, and hydrocolloid for superficial partial-thickness burns. In cases of suspected *Pseudomonas* infection, vinegar dressings were applied, sometimes supported by wound swabs.

Burn contractures disproportionately affect children from rural or impoverished backgrounds. In four reviewed studies, 60–80% of affected children belonged to low-income families [29]. In an Indian study, 25 out of 35 children aged 11–14 sought treatment primarily due to employment concerns, as burn-related disabilities led to lower wages or job rejections [30]. Financial constraints also limited access to rehabilitation, with families reluctant to undergo multi-stage procedures [31, 32].

Reconstructive techniques, particularly skin grafting, play a crucial role in restoring the protective skin barrier lost due to burns. Additionally, scar contracture remains a common complication requiring targeted surgical intervention. Of the 40 patients, 19 required surgery, while 21 healed conservatively. Scar contracture was absent in 15 patients (4 surgical, 11 nonsurgical), minimal in 14 (10 surgical, 4 nonsurgical), and severe in 11 (all surgical). Scar quality assessments showed that 14 patients had good scars, while hypertrophic (n=9), hyperpigmented (n=7), and immature (n=11) scars were also observed. Regarding range of motion (ROM), 20

patients regained full ROM (8 surgical, 12 nonsurgical), while 11 had limited movement, and 5 had unknown outcomes.

Burn contractures most commonly affected the hands (52%), feet (19%), and axillae (12%). Scald burns were the leading cause (49%), though geographic trends showed that flame burns were more common in Africa (47%), while scalds dominated in Asia (59%) [29]. In the present study, burn contractures most commonly affected the limb area of pediatric patients, with scald burns being the most common. Initial burn depth is a crucial predictor of severity and long-term outcomes. However, in many studies, severity was assessed indirectly, using parameters like "burns requiring >30 days to heal" or "deeper burns with skin removal" [14]. Unlike in developed countries, burn depth classification (first, second, or third degree) was not consistently reported [14, 29].

Hospitalization rates for pediatric burn victims in Bangladesh were 21.9 per 100,000 children per year, with infants being the most affected group (67.9 per 100,000 per year). This is slightly lower than hospitalization rates reported in Israel for infants and toddlers (103 and 23 per 100,000 per year, respectively). However, hospitalization rates among older children in Israel were similar to those found in our study [33].

The average hospital stay for pediatric burn patients in Bangladesh was 13.35 days, which aligns with findings from Turkey [34]. However, a shorter hospital stay (10.6 days) was reported in Iran [35]. As expected, hospitalization duration was significantly longer for severe burns, consistent with prior studies [8, 36]. The variability in hospital stay durations across different countries likely reflects differences in healthcare infrastructure, burn management protocols, and access to specialized burn care.

5. Limitations of the Study

Our study was a single-center study. We took a small sample size due to the short study period. As a tertiary care center, our department predominantly manages severe cases, leading to selection bias, as milder burns may have been treated in the community. Formal lower limb assessments were not conducted; instead, we relied on parental reports. After evaluating those patients, we did not follow up with them for the long term and did not know other possible interference that may happen in the long term with these patients.

6. Conclusion and Recommendations

In this study, we aimed to shed light on the incidence, severity, and outcomes of lower extremity burns in children within the context of our country. Lower extremity burns in pediatric patients present a serious health challenge. Whether through surgery or conservative management, the treatment does not always yield the desired results. Children who require multiple surgical procedures and repeated follow-ups for secondary surgeries often experience significant physical

and emotional distress. Their families, too, face considerable psychological and financial strain. Further study with a longitudinal study design including a larger sample size needs to be done to validate the findings of our study.

Abbreviations

DMCH	Dhaka Medical College and Hospital
ROM	Range of Motion
TBSA	Total Body Surface Area
STSG	Split-Thickness Skin Graft
FTSG	Full-Thickness Skin Graft

Author Contributions

Riffat Chowdhury: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

Mohammad Sadiqul Amin: Funding acquisition, Project administration, Supervision

Mohammad Mazharul Haque: Data curation, Investigation, Resources, Validation, Writing – review & editing

Iqbal Ahmed: Formal Analysis, Methodology, Software, Visualization

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Conflicts of Interest

The authors declare no conflicts of interest.

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