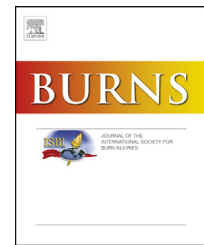


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# Epidemiology of pediatric burns in southwest China from 2011 to 2015

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## ABSTRACT

**Background:** Burns are a major form of injury in children worldwide. This study aimed to investigate the epidemiology, outcome, cost and risk factors of pediatric burns in southwest China.

**Methods:** This retrospective study was performed at the Institute of Burn Research of the Third Military Medical University from 2011 to 2015. Data, including demographic, injury-related, and clinical data and patient outcome, were collected from medical records.

**Results:** A total of 2478 children with burns (58.03% boys), accounting for 39.2% of total burn patients, were included. The average age of the burn patients was  $2.86 \pm 2.86$  years, and most patients (85.55%) were under five years old. The incidence of burns peaked in January, February and May. Scald burns were the most frequent (79.06%), followed by flame burns (14.0%) and electrical burns (3.35%). Limbs were the most common burn sites (69.73%), and the average total body surface area (TBSA) was  $11.57 \pm 11.61\%$ . The percentage of children who underwent operations and the number of operations were significantly increased in cases of electrical burns, the older-age group, a larger TBSA and full-thickness burns. Six deaths were recorded, yielding a mortality of 0.24%. The median length of stay and cost were 14 days and 9541 CNY, respectively, and the major risk factors for length of stay and cost were the TBSA, number of operations, full-thickness burns and outcome.

**Conclusions:** In southwest China, among children under five years old, scald and flame burns should become the key prevention target, and future prevention strategies should be based on related risk factors.

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## 1. Introduction

Burns are the 11th major cause of childhood deaths and the fifth most common cause of non-fatal childhood injury [1–3].

The prevalence of burns is higher among children younger than five years in low- and middle-income countries [2,4], and studies have shown that children comprise a major proportion of hospitalized burn patients [5,6]. Furthermore, pediatric burns lead to long-term physical, psychological and economic

*Abbreviations:* TBSA, total body surface area; ABSI, Abbreviated Burn Severity Index; BI, Burn Index; IQR, interquartile range.

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burdens on the victims and their families [7]. Therefore, special attention should be placed on the prevention and treatment of pediatric burns.

As a type of injury, most burns are preventable. High-income countries have successfully lowered the mortality rate associated with pediatric burns principally by adopting prevention strategies [1]. Specific and timely epidemiological data constitute the foundation for the development of effective strategies for the prevention of pediatric burns, the improvement of treatment effects and the reduction of the economic burden. However, no updated epidemiological data for pediatric burns in southwest China after 2010 are available [8,9]. The Institute of Burn Research of Southwest Hospital of the Third Military Medical University (TMMU) was one of the earliest burn centers in China and is one of the largest burn centers worldwide. This center contains 125 inpatient beds (including 18 ICU beds) and specializes in burn care and treatment. The center receives approximately 1300 burn patients annually from southwest China, including Chongqing, Sichuan Province and Guizhou Province. The aim of this study was to analyze the epidemiology and economic burden of pediatric burn patients in southwest China admitted to the burn center of the Southwest Hospital between January 2011 and December 2015.

## 2. Methods

### 2.1. Ethical approval and Data extraction

This retrospective study was approved by the Institutional Review Board of Southwest Hospital, the Third Military Medical University. The following data for pediatric burn patients (aged 0-14 years) admitted to the Institute of Burn Research of Southwest Hospital between January 2011 and December 2015 were collected from their medical records: demographical data, burn etiology, burn depth and area, injured anatomic locations, inhalation injury, time duration to hospital, number of operations, length of stay (LOS), patient outcome, and total cost. According to the healing of the patients' wounds and their basic conditions when discharged, the patients' outcomes were categorized as died, invalid, improved or cured as follows: if the patient was dead when discharged, the outcome was classified as "Died"; if the area of the burn wound did not decrease significantly or was worse after treatment, the outcome was classified as "invalid"; if the area of the burn wound was decreased but not eliminated after treatment, the outcome was classified as "improved"; and if the burn wound had completely healed and showed no residual wound, the outcome was classified as "cured". The response rate equaled the improve rate plus the cure rate. The Abbreviated Burn Severity Index (ABSI) [10], the modified Baux score [11] and the Burn Index (BI) [12] were calculated as follows:  $ABSI = \text{Gender (female}=1, \text{male}=0) + \text{Age}(0-20=1, 21-40=2, 41-60=3, 61-80=4, 80-100=5) + \text{Inhalation injury (yes}=1, \text{no}=0) + \text{Full-thickness burns (yes}=1, \text{no}=0) + \text{Total body surface area (TBSA) (1-10\%=1, 11-20\%=2, 21-30\%=3, 31-40\%=4, 41-50\%=5, 51-60\%=6, 61-70\%=7, 71-80\%=8, 81-90\%=9, 91-100\%=10)$ ;  $\text{Baux score} = \text{Age} + \%TBSA + 17 \times (\text{Inhalation injury}, 1 = \text{yes},$

$0 = \text{no})$ ; and  $BI = \%TBSA \text{ of the full-thickness burn} + \frac{1}{2} \times \%TBSA \text{ of the deep partial-thickness burn}$ .

### 2.2. Burn wound management

In our center, the standard plan for burn treatment mainly includes the following aspects: first aid, fluid resuscitation, surgical and nonsurgical wound management, prevention and treatment of infection, nutrition therapy, rehabilitation, diagnosis and treatment of inhalation injury. The wound management of thermal burns mainly includes the following steps:

1. Any clothing in the injured region should be immediately removed, and the burn wound should be flushed for approximately 30min with tap water;
2. The burn wound should be assessed, and this assessment should include a judgement of the burn area using the Chinese rule of nine, the burn depth by the 'Three degree and four categories', and the anatomic sites;
3. Fluid resuscitation using oral fluids (for a TBSA less than 10% in children) or intravenous fluid (for a TBSA greater than 10%) should be performed according to the Third Military Medical University protocol [13];
4. Cleansing, debridement and bandaging should be performed as early as the basic conditions allow. Small blisters could be left *in situ*, and large blisters should be broken and drained. The necrotized skin in deep partial-thickness burns and full-thickness burns should be removed to prevent infection.
5. Escharectomy or fasciotomy should be considered for circumferential full-thickness burns in the chest, limbs or digits, which are prone to cause impaired ventilation or distal circulation.
6. Surgical treatment should be considered only if burn wounds would not heal within two weeks. For full-thickness or deep partial-thickness burns across functional anatomic sites (hands and joints), the operations should be performed as soon as possible after fluid resuscitation. For major burn patients, a thorough treatment plan should be initially formulated, and early extensive escharectomy (whole excision of eschar for full-thickness burns and adjacent deep partial-thickness burns during one operation), accompanied by the establishment of a cooperative expert team (including experienced burn doctors, nurses and anesthesiologists) and accumulation of sufficient grafting skin and blood preparation, is recommended [14]. Autologous skin grafts, meshed grafts, MEEK grafts, micro-skin grafts, intermingling auto-allografts, large sheet allograft, and heterogenetic porcine skin grafts could be used to cover the wound bed.
7. Conservative management could be considered for the management of first-degree burns, partial-thickness burns and intermediate burns. Bandaging is always recommended for conservative treatment except burns on face, neck, axilla and perineum, which should be treated by the semi-exposure method. The dressing should be changed every day or every other day. Topical antibacterial agents, growth factor ointments and various wound dressings are commonly used.

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