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IMPACT OF PRE-HOSPITAL FIRST AID ON BURN OUTCOMES: INSIGHTS FROM THE 2024 NATIONAL BURN HOSPITAL DATABASE

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ABSTRACT

Background: *Burn injuries remain a major public health concern in low- and middle-income countries, where limited awareness of first aid and delayed access to specialized care contribute to poor outcomes. This study aimed to describe the epidemiological characteristics, pre-hospital first aid practices, and treatment outcomes among burn patients in Northern Vietnam.*

Subjects and methods: *A retrospective descriptive study was conducted among 750 burn patients admitted to the National Burn Hospital in 2024. Sociodemographic characteristics, burn etiology, clinical severity, first aid practices, and treatment outcomes were extracted from medical records. Associations between first aid quality and clinical outcomes were analyzed.*

Results: *The majority of patients were male (66.0%) and of working age. Thermal burns were the most common etiology (72.0%), followed by electrical (20.0%) and chemical burns (8.0%). Although 64.0% of patients received some form of first aid, only 34.7% received appropriate cooling with clean water, while 13.3% applied harmful substances. Timely first aid within 10 minutes occurred in only 24.0% of cases. Correct first aid was strongly associated with improved outcomes, including lower complication rates (15.4% vs. 34.7%), lower mortality (2.3% vs. 6.5%), and shorter hospital stays (14.2 vs. 21.0 days). Surgical intervention and ICU care were required in 41.3% and 24.0% of patients, respectively.*

Conclusion: *Burn injuries in Northern Vietnam predominantly affect working-age adults and are frequently associated with inadequate or inappropriate first aid. Early, evidence-based first aid particularly cooling with clean water is strongly associated with reduced complications, mortality, and length of hospital stay. Strengthening community education, improving occupational safety, and enhancing pre-hospital and referral systems are essential to reducing the burden of burns in the region.*

Keywords: *Burn injury; Epidemiology; First aid; Pre-hospital care; Treatment outcomes*

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1. INTRODUCTION

Burn injuries are among the most common and severe traumas, causing damage to the skin and underlying tissues due to heat, electricity, chemicals, or radiation. Globally, burns are recognized as a major public health issue, ranking fourth among all injuries. According to the World Health Organization (WHO), approximately 180,000 deaths occur annually due to burns, with the majority reported in low- and middle-income countries [1].

In Vietnam, particularly in rural areas of the Northern region, burn injuries remain a significant challenge for the healthcare system. Data from the National Burn Hospital indicate that the number of hospital admissions due to burns has been increasing, with children and women being the most affected groups. The primary causes are domestic activities such as cooking, boiling water, and using electrical appliances, as well as occupational accidents in industrial settings [2].

A major concern is the limited knowledge and inappropriate practice of first aid for burns among rural communities. Many individuals still rely on traditional remedies such as applying toothpaste, fish sauce, cooking oil, or honey to burn wounds. These practices not only worsen tissue damage but also increase the risk of infection, leading to severe complications or even death [3].

Therefore, assessing the knowledge and practice of burn first aid among rural populations in Northern Vietnam is essential. Mothers and caregivers play a crucial role as first responders when burn accidents occur at home. Findings from such studies will provide scientific evidence to guide health education programs, improve community awareness, reduce complications, and enhance treatment outcomes at specialized medical facilities.

2. METHODOLOGY

Study Design and Setting

This retrospective observational study was conducted at the National Burn Hospital in Hanoi, Vietnam. As the primary referral center for burn injuries in Northern Vietnam, the hospital receives patients from multiple provinces across the northern region. The study reviewed all eligible medical records of patients admitted with burn injuries between January 1 and December 31, 2024.

Research Team and Protocol Development

A multidisciplinary research team comprising burn surgeons, epidemiologists, and public health specialists was established to design and oversee the study. The team developed the study protocol, defined the research variables, and created a standardized data extraction form to ensure consistency in data collection. The protocol was submitted to and approved by the hospital's Scientific Council prior to implementation.

Data Extraction Tool

A structured data collection form was developed to capture detailed information on sociodemographic characteristics, burn etiology, clinical severity, pre-hospital first aid practices, treatment modalities, and patient outcomes. The draft form was pilot-tested using 30 randomly selected medical records from January 2024 to assess clarity, completeness, and feasibility. Feedback from the pilot phase was incorporated to refine and finalize the tool before full-scale data extraction.

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Study Population and Eligibility Criteria

The study population consisted exclusively of patients residing in Northern Vietnam who were admitted to the National Burn Hospital during the year 2024.

Inclusion Criteria

Patients were eligible for inclusion if they were residing in Northern Vietnam at the time of injury and were admitted to the National Burn Hospital between January 1 and December 31, 2024. Only cases with complete medical records containing sociodemographic information, burn characteristics, treatment details, and clinical outcomes were included in the analysis.

Exclusion Criteria

Patients were excluded if they lived outside Northern Vietnam, if their medical records lacked essential variables or contained incomplete documentation, or if they were discharged against medical advice. These criteria ensured the accuracy, consistency, and completeness of the dataset used for analysis.

Data Collection Procedures

Data were retrospectively extracted from the hospital's electronic medical record system by trained research assistants under the supervision of the research team. The collected variables included sociodemographic characteristics (age, sex, occupation, education level, and province of residence), burn characteristics (cause of burn, burn type, total body surface area affected, burn depth, and presence of inhalation injury), and details regarding pre-hospital first aid measures applied before admission. Treatment-related information encompassed surgical interventions, intensive care management, and rehabilitation services. Clinical outcomes were recorded in terms of mortality, complications, and length of hospital stay. All data were anonymized and coded prior to entry into the study database to ensure confidentiality and data integrity.

Data Management and Statistical Analysis

Data were analyzed using SPSS version 22. Descriptive statistics including frequencies, proportions, means, and standard deviations were used to summarize patient characteristics and clinical variables. Chi-square tests were applied to assess associations between categorical variables. Logistic regression models were used to identify factors associated with treatment outcomes such as mortality, complications, and prolonged hospitalization. Statistical significance was set at $p < 0.05$.

Ethical Considerations

This study was conducted as part of a commissioned scientific task assigned by the Department of Disease Control, Ministry of Health of Vietnam, aimed at strengthening evidence-based strategies for burn prevention and management in Northern Vietnam. In accordance with the commissioning requirements, strict compliance with scientific integrity, data protection, and responsible research conduct was maintained throughout the study.

All patient information extracted from the electronic medical record system was anonymized prior to analysis. No identifiable personal data were retained, and access to the dataset was restricted to authorized research personnel. The study involved no direct patient contact and posed no risk to participants.

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3. RESULTS

3.1. Sociodemographic Characteristics

A total of 750 patients from Northern Vietnam were included in the study. The majority were within the 18 - 40 age group (41.3%), followed by those aged 41 - 60 years (28.0%), indicating that burn injuries predominantly affected the working-age population. Males accounted for 66.0% of all cases, reflecting a higher occupational exposure to burn hazards.

Regarding occupation, workers (30.7%) and farmers (28.0%) represented the largest groups, consistent with the high-risk environments associated with industrial and agricultural activities. Most patients had completed secondary (34.7%) or high school education (29.3%), suggesting that burn injuries were not limited to populations with low educational attainment. Geographically, 65.3% of patients originated from provinces outside Hanoi, confirming the hospital's role as a major referral center for Northern Vietnam. (Table 1)

TABLE 1. Sociodemographic Characteristics of Patients (n = 750)

Variable	n	(%)
Age (years)		
18-40	310	41.3
41-60	210	28.0
> 60	110	14.7
Sex		
Male	495	66.0
Female	255	34.0
Occupation		
Workers	230	30.7
Farmers	210	28.0
Students	140	18.7
Others	170	22.6
Education level		
Primary	160	21.3
Secondary	260	34.7
High school	220	29.3
College/University	110	14.7
Residence (Northern Vietnam)	260	34.7
Hanoi	490	65.3
Other Northern provinces	120	16.0

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3.2. Burn Etiology and Clinical Characteristics (Table 2)

Thermal burns were the predominant cause, accounting for 72.0% of all injuries, followed by electrical burns (20.0%) and chemical burns (8.0%). More than half of the patients (56.0%) presented with TBSA < 10%, although 16.0% had extensive burns involving more than 20% TBSA.

In terms of burn depth, 52.0% sustained partial-thickness burns, while 24.0% had full-thickness injuries, indicating a substantial burden of severe burns. Inhalation injury was documented in 12.7% of cases, representing a clinically significant subgroup with higher expected morbidity and mortality (Table 2)

TABLE 2. Burn Etiology and Clinical Characteristics (n = 750)

Variable	n	(%)
Cause of burn		
Thermal	540	72.0
Electrical	150	20.0
Chemical	60	8.0
TBSA (%)		
<10	420	56.0
10-20	210	28.0
> 20%	120	16.0
Burn depth		
Superficial	180	24.0
Partial-thickness	390	52.0
Full-thickness	180	24.0
Inhalation injury		
Yes	95	12.7
No	655	87.3

3.3. Pre-hospital First Aid Practices (Table 3)

Among the 750 patients, 64.0% received some form of first aid before hospital admission. However, only 34.7% received appropriate cooling with clean water, while 13.3% applied harmful substances such as toothpaste, herbs, or fish sauce. Additionally, 8.0% used ice or excessively cold water, which is considered inappropriate.

Timeliness of first aid was suboptimal: only 24.0% received care within 10 minutes of injury, whereas 18.7% received first aid after more than 30 minutes, and 36.0% received no first aid at all. Most first aid was performed by family members (28.0%) or self-administered (20.0%), while only 5.3% was provided by healthcare workers, highlighting gaps in community-level emergency response capacity (Table 3).

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TABLE 3. Pre-hospital First Aid Practices (n = 750)

Variable	n	(%)
Received first aid		
Yes	480	**64.0**
No	270)	**36.0**
Time from burn to first aid		
<10 minutes	180	**24.0**
10-30 minutes	160	**21.3**
> 30 minutes	140	**18.7**
No first aid	270	**36.0**
Person performing first aid		
Self	150	**20.0**
Family member	210	**28.0**
Bystander	80	**10.7**
Healthcare worker	40	**5.3**
None	270	**36.0**
Type of first aid		
Cooling with clean water	260	**34.7**
Cooling with ice/cold water	60	**8.0**
Covering with clean cloth	120	**16.0**
Incorrect methods (toothpaste, herbs, fish sauce…)	100	**13.3**

3.4. Treatment Modalities and Outcomes

Surgical intervention was required in 41.3% of patients, and 24.0% required ICU care, reflecting the severity of injuries in this cohort. Rehabilitation services were utilized by 56.0% of patients during hospitalization.

The overall mortality rate was 5.1%, and 28.0% developed complications. A clear association was observed between first aid quality and clinical outcomes. Patients who received correct first aid had significantly lower complication rates (15.4% vs. 34.7%) and mortality (2.3% vs. 6.5%) compared with those who received incorrect or no first aid (Table 4)

TABLE 4. Treatment Modalities and Outcomes (n = 750)

Variable	n	%
Treatment modalities		
Surgical intervention	310	41.3
ICU care	180	24.0
Rehabilitation	420	56.0
Outcomes	38	
Mortality	210	5.1
Complications		28.0
Association with first aid	Correct first aid (n = 260) n (%)	Incorrect/no first aid (n=490) n (%)
Complications (n (%))	40 (15.4%)	170 (34.7%)
Mortality	6 (2.3%)	32 (6.5%)

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4. DISCUSSION

This study provides an updated and detailed overview of burn epidemiology, pre-hospital first aid practices, and treatment outcomes among 750 patients from Northern Vietnam. As the National Burn Hospital serves as the primary referral center for the region, the findings reflect both the clinical burden of burns and the systemic challenges in early burn management.

The demographic pattern observed, dominated by males (66.0%) and working-age adults, aligns with global evidence showing that burns disproportionately affect economically active populations in low- and middle-income countries (LMICs) [4,5]. Men in these settings are more frequently employed in high-risk occupations such as construction, manufacturing, and agriculture, where exposure to flame, hot liquids, and electricity is common. The high proportion of workers (30.7%) and farmers (28.0%) in our cohort reinforces the occupational nature of burn injuries in Northern Vietnam. These findings highlight the need for improved workplace safety regulations, enforcement, and training, particularly in informal sectors where compliance with safety standards remains limited [6].

Thermal burns accounted for 72.0% of all injuries, consistent with global patterns where flame and scald burns remain the predominant causes of injury [6,7]. Electrical burns represented 20.0% of cases higher than in many regional reports, suggesting persistent gaps in electrical safety, infrastructure maintenance, and public awareness. Similar trends have been documented in other rapidly industrializing Asian countries, where inadequate insulation, unsafe wiring, and lack of protective equipment contribute to electrical injuries among both workers and children [7,8]. These findings underscore the importance of strengthening electrical safety regulations and community education.

Although more than half of patients presented with TBSA < 10%, the proportion of deep and full-thickness burns (24.0%) and inhalation injury (12.7%) indicates substantial injury severity. Both factors are well-established predictors of mortality, prolonged hospitalization, and long-term disability [5]. The coexistence of relatively small TBSA with significant burn depth suggests that many injuries may have been preventable or could have been mitigated by timely and appropriate first aid. The burden of deep burns among working-age adults also implies major socioeconomic consequences, including loss of productivity, long-term rehabilitation needs, and psychosocial impacts that extend beyond the acute phase [5,9].

Pre-hospital first aid emerged as one of the most critical determinants of outcomes. Although 64.0% of patients received some form of first aid, only 34.7% received appropriate cooling with clean water. This is concerning given that immediate cooling with running water for at least 20 minutes is one of the most effective early interventions in burn management, reducing burn depth, edema, infection, and the need for surgery [9,10]. The persistence of harmful practices, such as applying toothpaste, herbs, or fish sauce (13.3%), reflects cultural misconceptions that have been documented in other Southeast Asian settings and are associated with delayed healing and increased infection risk [10].

Timeliness of first aid was also suboptimal. Only 24.0% of patients

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received first aid within 10 minutes, while 36.0% received none at all. Given the time-dependent benefits of cooling, these delays likely reduced the effectiveness of early management [9, 10]. The fact that most first aid was provided by family members (28.0%) or self-administered (20.0%), and only 5.3% by healthcare workers, highlights the reality that early burn care in Vietnam is largely community-based. This underscores the need for widespread public education campaigns and integration of burn first aid training into school curricula, workplace safety programs, and primary healthcare services.

The impact of first aid quality on clinical outcomes was striking. Patients who received correct first aid had significantly lower complication rates (15.4% vs. 34.7%), lower mortality (2.3% vs. 6.5%), and shorter hospital stays (14.2 vs. 21.0 days). These findings are consistent with international evidence demonstrating that early cooling improves outcomes and reduces healthcare burden [11]. In resource-limited settings, where advanced critical care and reconstructive surgery are costly and not universally accessible, improving first aid knowledge may be one of the most cost-effective strategies to reduce burn morbidity and mortality.

The need for surgical intervention (41.3%) and ICU care (24.0%) reflects the severity of cases reaching the national referral center. These proportions are comparable to those reported in tertiary burn units in other LMICs, where delayed presentation and inadequate pre-hospital care contribute to more severe injuries [11]. The overall mortality rate of 5.1% is within the expected range for specialized burn centers in similar settings but remains higher than rates reported in high-income countries, where robust trauma systems, early resuscitation, and advanced critical care have significantly reduced burn mortality [6, 8,11,12]. Bridging this gap in Vietnam will require improvements in pre-hospital care, early referral pathways, and critical care capacity.

Rehabilitation needs were substantial, with 56.0% of patients requiring rehabilitative services. This underscores the long-term functional and psychosocial impact of burns, including contractures, chronic pain, disfigurement, and challenges in returning to work or school [5,9]. Strengthening rehabilitation services, particularly outside major urban centers, is essential to improving long-term outcomes.

This study has several limitations. Its retrospective design may introduce information bias, particularly regarding first aid practices that rely on patient recall. As a single-center study, the findings may overrepresent severe cases and may not fully reflect the spectrum of minor burns managed at lower-level facilities. Long-term outcomes such as quality of life and return to work were not assessed.

Despite these limitations, the study provides valuable evidence for policy and practice. The strong association between first aid quality and outcomes highlights the urgent need for community-based education, improved occupational safety, and strengthened pre-hospital and referral systems. Integrating burn first aid into primary healthcare, school health programs, and workplace safety training could substantially reduce complications, mortality, and healthcare burden in Northern Vietnam.

5. CONCLUSION

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This study demonstrates that burn injuries in Northern Vietnam predominantly affect working-age adults and are frequently associated with inadequate or inappropriate pre-hospital first aid. Although most patients received some form of early care, correct cooling with clean water was applied in only one-third of cases, contributing to higher complication rates, increased mortality, and longer hospital stays. The strong association between proper first aid and improved outcomes highlights the critical importance of early, evidence-based interventions in reducing the clinical and economic burden of burns.

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