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Burns Across Seasons: Seasonal Effect on the Mechanism of Burn Injuries in Pediatric Patients Requiring Hospitalization

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ABSTRACT

Background: Burn injuries are a major cause of trauma in pediatric patients, comprising 17–25% of total burn admissions and ranking among the five most deadly childhood injuries. Seasonal variations significantly influence burn mechanisms due to changes in environmental conditions and activities. Scald injuries peak during colder months with increased use of hot water and heating appliances, while warmer months see more contact and electrical burns from outdoor activities and power surges. Despite the high burden in developing nations, limited research explores these seasonal patterns. **Objectives:** This study aimed to investigate the seasonal relationship with burn injury mechanisms in pediatric patients under 13 years of age. Specifically, it sought to identify seasonal variations in burn types, quantify hospitalizations across seasons, and assess associated hospital stay durations. **Methods:** A prospective analytical cross-sectional study was conducted at Mayo Hospital Lahore/KEMU from December 2023 to August 2024, including 120 pediatric patients with burns involving ≥10% of total body surface area (TBSA), face, hand, perineum, or signs of inhalation injury. Data were collected on scalds, flame burns, and electric burns, defined by standard classifications. **Results:** Among 120 patients, scalds (77 cases) were the most common, followed by flame burns (33 cases) and electric burns (9 cases). Scalds and flame burns peaked in winter (49% and 58%, respectively), while electric burns were most frequent in summer. Scalds and electric burns showed higher severity in summer, whereas flame burns exhibited consistent severity across seasons.

INTRODUCTION

Pediatric burns are a significant global health issue, particularly in developing nations, where they are ranked among the five most common fatal injuries in children.[1] These injuries are not only debilitating but also impose a substantial economic burden due to high treatment costs, extended hospital stays, and the need for rehabilitation.[2,3] Childhood burns account for 17–25% of burn admissions, with a significant threat to morbidity and mortality.[4] Understanding their causes, seasonal patterns, and associated hospital factors is essential for resource allocation and prevention strategies.

Globally, burn patterns and incidence vary due to differences in climate and socioeconomic factors.[5] Recent studies have highlighted a higher incidence of burn injuries during winter, particularly in low- and middle-income countries.[6,7] This increase is often attributed to the use of fire for heating and inadequate safety measures.[8] Conversely, the summer season sees a

rise in burns associated with electricity use for cooling.[9] Despite available research on burn etiology, the influence of seasonal changes on burn injuries and hospital admissions remains underexplored.

Children, particularly infants and neonates, are at greater risk due to their higher body surface area-to-mass ratio, which leads to increased fluid loss and higher resuscitation needs compared to adults.[10] Treating pediatric burns is particularly challenging in the absence of preventive guidelines and safety regulations, such as fire detectors, flammability standards for children's clothing, and proper maintenance of electrical systems. Additionally, gas shortages and power outages exacerbate the issue, contributing to higher burn incidents.

This study aimed to explore the seasonal variability in the mechanisms of burn injuries in pediatric patients requiring hospitalization. It specifically focused on scalds and other burn types, seeking to identify risk factors and provide evidence for preventive strategies.

MATERIALS AND METHODS

Study Design: This prospective analytic cross-sectional study was conducted at Mayo Hospital, a tertiary care pediatric center, for 9 months from December 2023 to August 2024. The study aimed to evaluate the seasonality in mechanisms of burn injuries, types, and severity of burn injuries among the pediatric age group requiring hospitalization.

Study Population: All pediatric patients up to age of 13 years, admitted to the hospital with burn injuries whether fresh, old, or follow-up cases during the study period were included. Patients whose parents/guardians did not know the circumstance or setting in which the burn occurred and patients with minor burns not requiring hospitalization were excluded.

Data Collection: Data was gathered prospectively through a structured questionnaire. the recorded variables were patient demographics (age, sex), type of burn injury (scalds, flame burn, and electrical burn) mechanism of injury, season of injury occurrence (winter, spring, summer), and length of hospital stay. The season was defined based on local climate: winter (December-February), spring (March-May), and summer (June-August).

Statistical Analysis: Data were analyzed using SPSS. Descriptive statistics were used to summarize the data, including mean, median, and standard deviation for continuous variables, and frequencies and percentages for categorical variables. Seasonal variations in the mechanism of burn injuries, the type of burns, the total number of patients requiring hospitalization, and the length of hospital stay were assessed. A p-value of <0.05 was considered statistically significant.

Ethical Considerations: The Institutional Ethics Committee of Mayo Hospital/KEMU Lahore approved this study. Written informed consent was obtained from the parents or legal guardians of all participants. Throughout the study, Data confidentiality and anonymity were maintained.

RESULTS

A total of 120 pediatric burn cases were included in the study, distributed across summer, spring, and winter seasons. Scald burns were the most frequent (77 cases), followed by flame burns (33 cases) and electric burns (9 cases), as shown in Table 1.

Table 1

Burn Types and Their Descriptive Statistics

Burn Type	N	Mean	Std. Deviation
Scald	77	0.9610	1.28187
Flame Burn	33	1.0909	0.87905
Electric Burn	9	0.1111	0.33333

The seasonal distribution of burn types is detailed in Table 2. Scald burns were most common in winter, accounting for 49% (38 cases), followed by spring (23%, 18 cases) and summer (27%, 21 cases). The highest mean rank for scald burns was observed in summer (44.02), indicating greater severity during this season.

Table 2

Seasonal Distribution of Burn Types

	Season	N	Percentage	Mean Rank
Scald	winter	38	49%	35
	spring	18	23%	41.58
	summer	21	27%	44.02
	Total	77		
Flame burn	winter	19	58%	16.05
	spring	7	21%	16.14
	summer	7	21%	20.43
	Total	33		
Electric burn	winter	2	22%	4.5
	summer	7	78%	5.14
	Total	9		

Flame burns peaked in winter (58%, 19 cases), while spring and summer each accounted for 21% (7 cases). The severity of flame burns remained consistent across seasons, as indicated by similar mean ranks (16.05 in winter, 16.14 in spring). Electric burns showed a distinct seasonal pattern, with 78% (7 cases) occurring in summer and 22% (2 cases) in winter. Although less frequent, electric burns in summer had a higher mean rank (5.14) compared to winter (4.5), indicating slightly increased severity during warmer months.

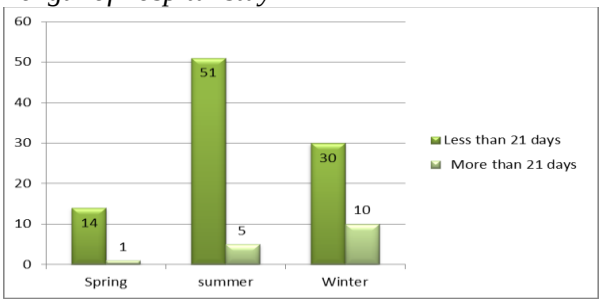
The statistical analysis revealed a significant association between the season and the mechanism of burn injuries. The chi-square test produced a p-value of 0.0282, which is below the threshold of 0.05, indicating statistical significance. The chi-square statistic of 10.86 with 4 degrees of freedom suggests a moderate strength of association between these variables. Electric burns remained relatively consistent across seasons, with a slight increase observed during the summer months. Flame burns exhibited seasonal variability, peaking in summer, followed by winter, and with the lowest occurrence in spring. Scald burns were most prevalent in winter, moderately common in summer, and least frequent in spring. Summer recorded the highest total number of burn cases, with a significant increase in flame burns contributing to the seasonal burden. In winter, scald burns dominated, accounting for a substantial proportion of injuries. Spring saw the lowest numbers of burn injuries across all mechanisms, reflecting a relatively milder seasonal impact.

The number of patients requiring hospitalization varied significantly by season. Summer accounted for the highest number of hospitalizations (56 patients) but not the longest average stay. Winter followed with 40 patients, with slightly longer hospital stays, contributing to the second-highest burden. Spring had the fewest hospitalizations (15 patients) and the shortest average stay, resulting in the lowest overall impact on healthcare resources.

The analysis revealed a trend towards longer hospital stays in winter, with a significantly higher proportion of stays exceeding 21 days compared to other seasons. Winter demonstrated an odds ratio of 4.67 for prolonged stays relative to spring. However, the chi-square test yielded a p-value slightly above the conventional significance threshold, indicating a notable trend without definitive statistical significance (Figure 1).

Figure 1

Length of hospital stay



While differences in hospital stay lengths between seasons were not strongly statistically significant, seasonal patterns were evident. Summer recorded the highest patient burden, driven by a greater number of admissions rather than extended hospitalizations. This could be attributed to increased outdoor activities and specific risks associated with summer. Winter exhibited the second-highest burden, characterized by fewer hospitalizations but slightly prolonged stays, potentially due to the severity of burn injuries or related complications during colder months. In contrast, spring had the lowest overall burden, with fewer admissions and shorter stays, serving as a baseline for resource allocation and comparison with other seasons.

DISCUSSION

This study on seasonal variations in pediatric burn injuries in Pakistan offers valuable insights into the patterns and mechanisms of burns across different seasons. Pediatric burn patients form a significant portion of burn cases across all age groups, consistent with findings from a study[11] and the World Health Organization's report[12] on child injuries. The results demonstrate a significant association between seasons and burn mechanisms ($p = 0.0282$), suggesting that environmental and behavioral factors unique to each season influence burn injuries among children. Electric burns showed relative consistency across seasons but increased slightly in summer, likely due to the frequent use of electrical appliances for cooling. Flame burns peaked in summer, possibly linked to outdoor activities such as barbecues or campfires, while scald burns were most prevalent in winter, likely associated with the increased use of hot liquids for warmth. Summer recorded the highest

number of burn cases (56), followed by winter (40), while spring had the lowest (15). However, winter was associated with longer hospital stays, with a significantly higher proportion of stays exceeding 21 days (OR = 4.67 compared to spring), raising questions about the role of severe injuries or slower healing processes in colder months. These findings are consistent with global studies[13, 14] that highlight scald burns as a leading cause of injury, though differences are observed with regions like the United States[15], where flame burns predominate.

Strength, Limitations and Future Suggestions

The study's strength lies in its detailed analysis of seasonal trends, providing actionable data for prevention and resource planning. However, its limitations include the observational design, which precludes causal inferences, and its restriction to a single region, which may limit generalizability. Future multicenter studies with larger sample sizes are recommended to validate these findings and explore underlying factors for seasonal variations in burn injuries, including socioeconomic and cultural influences. These insights could guide the development of targeted prevention strategies and efficient resource allocation in burn care settings.

CONCLUSION

This study provides a valuable foundation for understanding the seasonal dynamics of pediatric burn injuries in Pakistan. By leveraging this information, healthcare providers, policymakers, and community leaders can work together to develop more effective strategies for preventing burn injuries and improving outcomes for affected children. The seasonal approach to burn prevention and management highlighted by this research could serve as a model for similar studies in other developing countries, contributing to a global reduction in the burden of pediatric burn injuries.

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