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The effect of seasonality on burn incidence, severity and outcome in Central Malawi

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ABSTRACT

Introduction: In much of the world, burns are more common in cold months. However, few studies have described the seasonality of burns in sub-Saharan Africa. This study examines the effect of seasonality on the incidence and outcome of burns in central Malawi.

Methods: A retrospective analysis was performed at Kamuzu Central Hospital and included all patients admitted from May 2011 to August 2014. Demographic data, burn mechanism, total body surface area (%TBSA), and mortality were analyzed. Seasons were categorized as Rainy (December–February), Lush (March–May), Cold (June–August) and Hot (September–November). A negative binomial regression was used to assess the effect of seasonality on burn incidence. This was performed using both the raw and deseasonalized data in order to evaluate for trends not attributable to random fluctuation.

Results: A total of 905 patients were included. Flame (38%) and Scald (59%) burns were the most common mechanism. More burns occurred during the cold season (41% vs 19–20% in the other seasons). Overall mortality was 19%. Only the cold season had a statistically significant increase in burn. The incidence rate ratios (IRR) for the hot, lush, and cold seasons were 0.94 (CI 0.6–1.32), 1.02 (CI 0.72–1.45) and 1.6 (CI 1.17–2.19), respectively, when compared to the rainy season. Burn severity and mortality did not differ between seasons.

Conclusion: The results of this study demonstrate the year-round phenomenon of burns treated at our institution, and highlights the slight predominance of burns during the cold season. These data can be used to guide prevention strategies, with special attention to the implications of the increased burn incidence during the cold season. Though burn severity and mortality remain relatively unchanged between seasons, recognizing the seasonal variability in incidence of burns is critical for resource allocation in this low-income setting.

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1. Introduction

Injury is a leading cause of death worldwide and burn is disproportionally common in low and middle-income countries (LMICs), where 95% of burns occur [1]. An estimated 300,000 deaths occur yearly from fires; and fire-related injuries are the 6th leading cause of death in children aged 5–14 years old [2]. In addition, millions more suffer life-long disability and disfigurement from burns. These injuries are often attributable to cooking conditions and methods, poor access to safe energy source, crowded living conditions, and a lack of knowledge of potential risks [3]. Ultimately, burn is a disease of poverty.

Seasonality describes the cyclical fluctuation in time-series data. Describing seasonal patterns, as well as understanding the deviations from these patterns, is useful for predicting trends and planning resource allocation for services that may vary throughout the year. In most geographic regions with four distinct seasons, burns are more common in colder months, as people are more likely to use fires for both cooking and heating [4].

Despite the potential importance of seasonality in burn, available data on the seasonality of burn in sub-Saharan Africa are scarce. Among the many uses of injury surveillance programs is the potential to alert health authorities and communities to emerging injury trends, guide resource allocation, and facilitate development of prevention measures. This is particularly important in resource-poor settings, where limited resources must be distributed carefully.

Given the dearth of epidemiologic studies assessing seasonality in burn patterns in sub-Saharan Africa, the primary objective of this study is to evaluate seasonality in burn hospitalization and identify any temporal relationships in burn and outcome using data from a burn registry database in central Malawi.

2. Methods

2.1. Setting

This study is a retrospective analysis of prospectively collected burn registry data from patients admitted to the Kamuzu Central Hospital (KCH) burn unit from May 2011 to August 2014. KCH is an 800-bed tertiary care hospital in the capital city of Lilongwe, which serves as a referral center for approximately 5 million people in the Central Region of Malawi [5,6]. The burn unit at KCH was established in 2011 in collaboration with the University of North Carolina, Department of General Surgery. Pediatric and adult patients are admitted to the same unit, which consists of 31 beds and is staffed by 6 full-time and specially trained nurses and 2 clinical officers. There are no full-time plastic surgeons present at KCH, although international plastic surgeons occasionally visit for short missions. Although there are general surgeons and general surgery residents engaged full time at the hospital, the majority of the clinical decision making and operative procedures performed in the burn unit are performed by 2 clinical officers who have

received training in burn excision and skin grafting with consultant general surgeon oversight.

An average of 23 patients was admitted to the burn unit every month during the study period. A burn registry was established to collect patient demographics, clinical characteristics, and outcome. Specifically, variables utilized in this study include age, gender, season of injury, mechanism of injury, time to presentation to hospital, total body surface area (TBSA) burned, length of hospital stay, and survival. Once admitted to the burn unit, all patients are treated in a similar manner based on burn and associated medical issues.

2.2. Seasonality

Seasons were grouped into four 3-month periods: the rainy season (December–February), the lush, green season (March–May), the cold, dry season (June–August), and the hot, dry season (September–November). Average temperature fluctuates throughout the year from an average of 23.3°C during the hot season (range 17–29°C) to an average of 18.3°C during the cold season (range 7–23°C). The seasons in Malawi are generally predictable, although the lush, green season can vary in length, temperature, and amount of rainfall.

2.3. Establishing seasonality and deseasonalizing the data

For data influenced by seasonal trends, deseasonalizing the data serves to smooth the seasonal variations in order to look for irregularities in the pattern and allow for forecasting. This was performed by calculating burn incidence for each month during the study period and calculating a seasonal index using a three-mean centered average. The number of burns each month was then divided by the adjusted seasonal index in order to calculate the deseasonalized number of burns.

2.4. Statistical analysis

The initial cohort was described using means and percentages and bivariate analysis was used to compare patient characteristics, hospital course, and outcome between seasons. Pearson's Chi-square test was used to compare categorical variables. T-tests were used to describe normally distributed continuous variables and K-sample equality-of-means test was used for highly skewed continuous variables. Negative binomial regression modeling was performed to compare the incidence of burn between seasons. Both the crude and deseasonalized data were included in the negative binomial regression in order to determine whether the observed differences were due to seasonality or random fluctuation. The results were described using incidence rate ratios (IRR—defined as the ratio between the observed and expected numbers of burn in each season) and 95% confidential intervals (CI).

For all calculations, a p-value of less than 0.05 was considered statistically significant. All statistical analysis was performed using Stata/SE 13 (StataCorp LP, College Station, TX). The University of North Carolina Institutional Review Board and the Malawi National Health Sciences Review Committee approved this study.

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