Injury, Int. J. Care Injured 44 (2013) 1477–1482

Contents lists available at SciVerse ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Pediatric burn injuries in South Africa: A 15-year analysis of hospital data

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ARTICLE INFO

Article history:
Accepted 16 December 2012

Keywords:
Burns
Child injuries
Unintentional injuries
Trauma
Low- and middle-income countries
South Africa

ABSTRACT

Introduction: Burns are a significant burden of pediatric injuries, particularly in low and middle-income countries, were more than 90% of burn-related pediatric deaths occur. This study explores pediatric burn-related injuries over a fifteen year time period in South Africa through an analysis of a pediatric trauma surveillance system.

Methods: This retrospective observational study used data collected by Childsafe South Africa from the Red Cross War Memorial Children's Hospital (RCH) trauma registry in Cape Town, South Africa between 1995 and 2009 for children less than 13 years of age who presented with burn injuries to the hospital's casualty department. Demographic data and Abbreviated Injury Scores (AISs) were first assessed, followed by an analysis of time trends using Poisson regression. Logistic regression models were used to analyse factors related to hospital admissions.

Results: Between 1995 and 2009, 9438 children with burn-related injuries presented to RCH, of which nearly three-quarters resulted from scalds (73%; $n = 7024$). The mean age of the injured children was 3.1 ± 2.9 years 58% were male. 11 deaths occurred in the hospital's casualty department. 39% of injuries were minor, 56% were moderate, and 5% were severe. During the 15-year study period, moderate burn injuries increased by 3%, while minor injuries decreased by 10% ($p < 0.05$). 49% of all children were admitted to the hospital. Hospital admissions increased by 3% ($p < 0.05$) during the study period.

Conclusions: Pediatric burn injuries are a significant contributor to the burden of child diseases in developing county hospitals. Pediatric surveillance systems, such as Childsafe South Africa's, are important to study epidemiologic changes in burn injuries. Findings suggest the need for targeted interventions to address the prevention of specific burn-related injuries.

Introduction

Burns are a significant burden of pediatric injuries. In 2008, more than 47,000 children less than 15 years of age died from burn-related injuries worldwide.[1] Mortality from pediatric burns is most pronounced in low- and middle-income countries (LMICs) where over 90% of burn-related pediatric deaths occur.[2] This is equivalent to 3.4 burn-related deaths per 100,000 children in LMICs compared to 0.5 deaths per 100,000 in high-income countries.[1] By region, the World Health Organization's (WHO) African region has the highest rate of pediatric burn-related deaths at 7.03 per 100,000 children.[1] South Africa, an upper middle-income country, has a rate of 2.8 burn-related deaths per 100,000 children, which is more than five times higher than other upper middle-income countries which average 0.5 burn-related deaths per 100,000 children.[1]

Efforts to address the burden of pediatric burn injuries are hindered by the paucity of data available in LMICs.[3] This is especially true in Africa: when the WHO conducted the 2008 Global Burden of Disease, 42 of 45 African countries did not report country specific pediatric burn data. As a result, the WHO established its 2008 pediatric burn-related mortality rates for all

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0020–1383/$ – see front matter © 2013 Published by Elsevier Ltd.
http://dx.doi.org/10.1016/j.injury.2012.12.017

but three African countries using modelling estimates.[1] South Africa's national burn-related mortality data were based on incomplete death registration data, while only the Seychelles and Mauritius had reasonably complete death registration data.[1]

In countries where national surveillance systems are unavailable or limited, epidemiologic injury data can be obtained through hospital-based surveillance records. Studies have explored the epidemiology of hospital-based burns in Sub-Saharan Africa among adults, many of which were conducted in South Africa.[4–11] However, the etiologies of burn injuries in adults and children are substantially different and fewer studies have described burn injuries specifically among pediatric populations in Sub-Saharan Africa.[12–14]

In South Africa, and Cape Town in particular, there has been a strong effort to research the burden and treatment of pediatric burns and prioritise burn prevention.[15–17] However, studies have not often described changing patterns in the epidemiology of pediatric burn injuries over time. This is paramount to appropriately inform targeted prevention strategies. Through a description of data collected from a hospital-based trauma surveillance system in Cape Town, South Africa, the overall goal of this study is to explore the changing epidemiology of pediatric burn injuries over a 15-year period. Specifically, this study will explore trends in injuries in three five-year intervals and determine the extent to which characteristics are related to admission.

Methods

This study analysed data collected from Childsafe South Africa's trauma surveillance system at the Red Cross War Memorial Children's Hospital (RCH), a referral pediatric hospital for children less than 13 years of age in Cape Town. Childsafe South Africa is a non-governmental organization that maintains a surveillance system of all injured children presenting to RCH's casualty department. All children with a burn-related injury captured in the trauma surveillance system between January 1995 and December 2009 were included in this study.

Retrospective data included the children's age, gender, cause of burn, place of occurrence, injury severity, and disposition from the casualty department. Cause of burn injury included scalds, flame, heat contact, chemical, electrical, explosion, and other causes. Injury severity was established using RCH's four-point Abbreviated Injury Score (AIS) of 'mild', 'moderate', 'severe', and 'death'. The AIS score is assigned to each patient by the clinician in the casualty department after they assessed the patient. In terms of disposition, patients were admitted to RCH, discharged from the casualty department, or died in the casualty department.

Surveillance data were entered into a Microsoft Access® database. Data analysis was conducted using STATA 11.0.[18] Descriptive analyses were performed for demographic characteristics and injury mechanisms. To assess differences, the Chi Square test was used for dichotomous variables and the *t*-test was used for continuous variables.[19] Age was treated as both a continuous and a categorical variable; age was analysed in groups commonly used in the pediatric literature (children 0–4 years of age, 5–9 years of age, and 10–12 years of age) and in one-year intervals.[2] Additionally, to examine particular differences among the youngest and oldest children, age groups were also categorised into 13 one-year age groups from 0 to 12 years of age.

To determine the age-adjusted annual incidence of injuries presenting to RCH, changes within the population were adjusted using the South African 1996 and 2001 censuses data and the South African mid-year adjusted rates from 2003, 2004, and 2005 for children 0–12 years of age in the Western Cape.[20] Assuming equal annual population increases over the fifteen-year study period, age-specific population changes were linearly approximated. The number of burn injuries that occurred during the study period was assumed to follow a Poisson distribution and further supported by testing the negative binomial distribution.[19] Poisson regression models were used to analyse trends in pediatric burn injuries over the fifteen-year period.[21] To evaluate nonlinear changes in the rate of burn injuries per 100,000 person years during the study period, linear spline terms were introduced to model time in five-year time bins.[22] A p value of less than 0.05 was considered statistically significant.

The primary outcome was measured in terms of hospital admission. Logistic regression was used to describe factors associated with admission, including age, gender, AIS score, cause of burn, and anatomic location of the burn. Three regression models were constructed from the data set and fit to estimate trends for admitted patients. The initial model, Model A, included age, gender, and injury severity. The second model, Model B, included those factors in Model A as well as cause of burn injury. The final model, Model C, added anatomic location of the injury. Cause and anatomic location reference groups for the models were chosen according to the group with the least number of observations.[19] To determine the model with the best differentiation, we used the Akaike Information Criterion (AIC) to compare the goodness of fit of competing predictive models and then chose the model with the lowest AIC score.[23]

This study was approved by the ethical committee of the University of Cape Town in South Africa and the Johns Hopkins Bloomberg School of Public Health Institutional Review Board in Baltimore, Maryland.

Results

Between 1996 and 2009, 9438 children with 12,650 burns presented to RCH's casualty department. 58% of the children were male (n = 5494). The mean age of the injured children was 3.1 ± 2.9 years (Table 1). Nearly 80% of burn injuries occurred in children 0–4 years of age, and more than one-third of injured children were one year of age (n = 3340; 35%). Boys were more 1.39 times more likely to sustain burn injuries than girls ($p < 0.05$). This ratio is lowest among five year olds (1.2; $p < 0.05$) and highest among 12 year olds (1.8; $p < 0.05$); it is also high among infants and one-year olds (Fig. 1).

Table 1
Demographic data of children with burn injuries at Red Cross War Memorial Hospital, Cape Town, South Africa between 1995 and 2009 (n = 9438).

	Burn injuries	
	Number	Percentage
Age		
0–4 years	7497	79%
5–9 years	1479	16%
10–12 years	463	5%
Gender		
Boys	5492	58%
Girls	3947	42%
Severity of burn injury		
Minor	3709	39%
Moderate	5267	56%
Severe	452	5%
Death	11	0.1%
Place of occurrence		
Own home	8693	92%
Other home	323	3%
School/preschool	37	0.4%
Public place	131	1%
Other	172	2%
Unknown	82	0.9%
Admission to hospital		
Admitted	4632	49%