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Sustained high incidence of injuries from burns in a densely populated urban slum in Kenya: An emerging public health priority

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ABSTRACT

Introduction: Ninety-five percent of burn deaths occur in low- and middle-income countries (LMICs); however, longitudinal household-level studies have not been done in urban slum settings, where overcrowding and unsafe cook stoves may increase likelihood of injury.

Methods: Using a prospective, population-based disease surveillance system in the urban slum of Kibera in Kenya, we examined the incidence of household-level burns of all severities from 2006–2011.

Results: Of approximately 28,500 enrolled individuals (6000 households), we identified 3072 burns. The overall incidence was 27.9/1000 person-years-of-observation. Children <5 years old sustained burns at 3.8-fold greater rate compared to ($p < 0.001$) those ≥5 years old. Females ≥5 years old sustained burns at a rate that was 1.35-fold ($p < 0.001$) greater than males within the same age distribution. Hospitalizations were uncommon (0.65% of all burns).

Conclusions: The incidence of burns, 10-fold greater than in most published reports from Africa and Asia, suggests that such injuries may contribute more significantly than previously thought to morbidity in LMICs, and may be increased by urbanization. As migration from rural areas into urban slums rapidly increases in many African countries, characterizing and addressing the rising burden of burns is likely to become a public health priority.

1. Introduction

Severe burns from fires alone (not including scalds) account for more than 300,000 deaths annually with approximately 95% of burns occurring in LMICs (low and middle-income countries), where resources to treat and manage injuries are scarce or unavailable [1]. The rate among populations living in urban slum environments is a particular concern because overcrowding increases the potential for infants and toddlers to experience non-intentional burns, especially during cooking where fires can spread rapidly, injuring many people simultaneously. As migration from rural areas to urban slums in many African countries continues at rates of 3–7% per year

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[2], addressing the rising burden of burn injuries is likely to become a public health priority.

Studies of burn injuries conducted through hospitals and clinics in Africa, Asia and Latin America, including India [3], Pakistan [4], Nepal [5], Nigeria [6], Ghana [7], Sri Lanka [8], South Africa [9], and Peru [10] have highlighted that they are an emerging public health problem. However, documentation of burn injuries of varying severity at the household-level is available only from Ghana [11] and Bangladesh [12]; these studies found substantially higher rates than those that ascertained cases in formal healthcare settings. There have been no longitudinal, prospective studies in an urban slum setting. We carried out a 5-year analysis based on household surveillance data eliciting information about burn injuries of all severities within two villages in Kibera, a large urban slum in Nairobi, Kenya, to define the magnitude of the problem and to inform public health interventions, policy, and future research agendas.

2. Methods

2.1. Population-based surveillance

The United States Centers for Disease Control and Prevention (CDC) and the Kenya medical research institute (KEMRI) have collaborated on population-based infectious disease surveillance (PBIDS) in Kibera since 2005 [2,13]. PBIDS includes both household- and clinic-based surveillance components. Written informed consent was obtained for data collection at the clinics and households. Written informed consent for minors was obtained from their parent or guardian. The protocol and consent forms were reviewed and approved by the ethical review boards of KEMRI (#932) and the Institutional Review Board of the CDC (#4566).

The household study population in Kibera consists of approximately 28,500 (range 25,000–30,000) enrolled individuals, representing about 6000 households living in a surveillance area measuring approximately 0.37 km^2 (population density = 77,000/km^2). Participants in PBIDS were assigned a unique identification number and agreed to regular household interviews conducted by community interviewers (CI's) who systematically collected data into pre-programmed personal digital assistants (PDAs). Interviews included general illness questions about illnesses or events, including whether individuals within the household had sustained a burn or been involved in an injury/accident since the last scheduled household interview, one or two weeks before. Community interviews took place biweekly during the first years of the study. In the final quarter of 2009, a transition was made to weekly interviews in an attempt to limit recall bias, as previously described [14].

Quality-control checks, including independently repeated interviews (by field supervisors), accompanied interviews, automatically generated performance scorecards for each CI (using data collected from the clinic to cross-check and validate data collected on the same illness from the same patient during the home visit), and use of ''red herrings'' within the interview process (which include listing non-existent residents to be interviewed) to ensure that CI's were visiting households and completing interviews, were integrated into the system to ensure that interviews are conducted according to protocol, results are consistent, and data are appropriately managed. PDAs were programmed using visual basic .Net 2005 and data stored in an SQL database 2005 (Microsoft, Redmond, WA).

Questions were asked directly of participants ≥5 years of age who were at home at the time of the visit. For participants who were not home or for those <5 years of age, a knowledgeable proxy, typically a parent, spouse, or sibling was asked to respond as a substitute. Whether a participant or proxy completed the interview is noted. When neither the participant nor a suitable proxy was interviewed, the participant was documented as not home for that round, and the interview documented as attempted, but not completed.

The study clinic (Tabitha Clinic, operated by Carolina for Kibera and staffed by the CDC/KEMRI collaboration) provides free outpatient care for all acute illnesses for all participants enrolled in PBIDS, and at a standardized tariff for other residents of Kibera not enrolled in PBIDS or for non-covered conditions. Care for chronic illnesses or traumatic events, including burns, are not covered conditions in the project, so clinic visits for burns are charged at the standard tariff. The clinic uses an electronic medical records system in which clinicians can enter information into a free-text field including chief complaint and past medical history about non-study conditions like burn injuries. Data were collected for clinic surveillance by chart review of these fields.

2.2. Time period

The study period for analysis of the household interview data was July 1, 2006 through June 30, 2011. For the clinic data, visits from July 1, 2006 through March 31, 2010 were analyzed.

2.3. Burn injury case-definitions

For household surveillance, participants were defined as having sustained a unique ''burn injury'' if they or a proxy answered affirmatively to the question ''In the last two weeks, have you had a burn?'' during the biweekly reporting period or ''In the last week, have you had a burn'' during the weekly reporting period and had no history of an affirmative answer to this question within the preceding 14 days. The number of unique burn-injuries from household surveillance provided the numerator for incidence rate calculations. There were no follow-up probe questions about severity or etiology of burn injury during the household surveillance. Questions about hospitalization including number of days in hospital and other healthcare care sought were asked later in the interview and linked to the individual's household data. Because the surveillance is principally designed to characterize the epidemiology of infectious diseases, no additional information was collected during home visit about burn injuries.

For clinic surveillance, patients enrolled in PBIDS who presented to the study clinic with a chief complaint of burn or mention of a burn during either the physical examination or description of symptoms were considered to have sustained a burn injury. Each data record was individually screened to