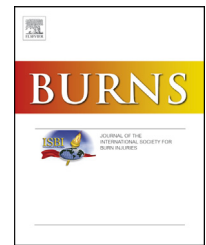


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Prevention of burn injuries in low- and middle-income countries: A systematic review

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ABSTRACT

According to the World Health Organization (WHO), burns result in more than 250,000 deaths and the loss of approximately 18 million disability adjusted life years (DALYs), more than 90% of which occur in low- and middle-income countries (LMICs), annually. This type of serious injury – one that is particularly devastating in LMICs – is preventable. To further explore the effectiveness of burn prevention strategies in LMICs, we performed a systematic review of the literature indexed in PubMed, EMBASE, Web of Science, Global Health, and the Cochrane Library databases as of October 2015. Our search resulted in 12,568 potential abstracts. Through multiple rounds of screening using criteria determined *a priori*, 11 manuscripts were identified for inclusion. The majority of these studies demonstrate reductions in hazardous behaviors, incidence of burns, morbidity, and mortality using educational programs, but also highlight other initiatives, such as media campaigns, as effective strategies. Given that only 11 manuscripts are highlighted in this review, it is evident that original research is lacking. Further studies of preventative efforts tailored to populations in LMICs are needed. It is also essential that these studies be founded in population-based epidemiology and use meaningful end points, such as reductions in incidence, morbidity, and mortality.

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1. Introduction

The World Health Organization (WHO) ICD-10 codes broadly define a burn, with the exception of sunburn, as an injury caused by heat (hot objects, gases, or flames), chemicals, electricity and lightning, friction, or radiation [1]. Burns result in more than 7.1 million injuries, the loss of almost 18 million disability-adjusted life years (DALYs) (approximately 94% of those in LMICs), and more than 265,000 deaths (approximately 92% of those in LMICs) worldwide annually [2]. This morbidity and mortality, as with many injuries, is largely understood to be preventable. Literature on the development and application of initiatives aimed at the prevention of burns and their outcomes in high income countries (HICs) is fairly abundant [3], but little is known about prevention strategies and their effectiveness in LMICs.

Several well-known preventative initiatives and acts of legislation have been named in the literature and in public media; these include the Household Energy Safety Association of Southern Africa [4], the Safe Bottle Light, or Sudeepa, Campaign in Sri Lanka [5], and the Acid Control Act of 2002 in Bangladesh. Additionally, specific groups such as the Acid Survivors' Foundation in Bangladesh [6] exist in order to raise awareness about burns and support survivors and families, but the actual impact of these interventions and groups has not been formally reported.

To date, much of the research related to burn prevention in LMICs has been conceptual and has failed to demonstrate an impact on the morbidity or mortality of burns in LMICs [7,8]. For example, Parbhoo et al. conducted an extensive review of population-based initiatives and call for a broad group of interventions (e.g. better equipment, home inspections/counseling, regulated thermostats, safe storage of flammables, better ventilation, prevention programs, legislation, environment modification, supervision, community education, child education, parent education, health worker education, guarding fires, home redesign, flame retardant clothing/objects, and, particularly in LMICs, broad community-action interventions to improve socioeconomic status); however neither the manuscripts they list nor the interventions they propose have been studied for effectiveness in LMICs [8].

Similarly, Peck et al. use the concept of the Haddon Matrix and existing epidemiological data to propose strategies to address non-electric appliance fires, including interventions targeting components that affect the incidence and the impact of burns – host/human factors, object/substance factors,

physical environment factors, and sociocultural environment factors. The study also examines concerns regarding effectiveness, cost, freedom, equity, stigmatization, and feasibility, but offers neither detailed interventions targeted to the at-risk populations nor outcomes from these proposals [7]. In fact, there are many other studies that highlight other epidemiological principles, such as the concepts of active and passive interventions [3,9], and that often propose very specific interventions based on highlighted epidemiological statistics or identification of risk factors [5,7,9–39], however this data is often limited to hospital-based data, instead of population-based data, and again fails to examine the effectiveness of the interventions proposed from these data.

While certain studies do highlight investigations into the effectiveness of educational interventions, they only discuss the acquisition of knowledge (often short-term retention) and not the impact on at-risk behaviors, or more importantly, on incidence, morbidity, or mortality [40–49].

Literature on specific interventions and their effectiveness at reducing incidence, morbidity, and mortality from burns in LMICs is lacking. Our literature review aims to address this by highlighting manuscripts that describe not only detailed burn prevention interventions conducted in LMICs, but also study their effectiveness with measurable outcomes.

2. Materials and methods

We performed a systematic review of the literature indexed in PubMed, EMBASE, Web of Science, Global Health, and the Cochrane Library databases as of October 2015. Abstracts were limited to human studies in English. The initial search returned 12,568 abstracts, 4248 which were duplicates that were excluded prior to review. On primary review of the remaining 8320 abstracts, 6432 were excluded by two reviewers (with conflicts resolved by a third) using the following *a priori* exclusion criteria: non-human subjects; not in English; not a complete manuscript (e.g. only an abstract, poster presentation, lecture, letter, or short communication); not conducted in a LMIC – as defined by the World Bank classification of countries as of June 1, 2013 [50] as the search was initially done in June 2013 and then updated in October 2015; and a manuscript without a focus on thermal, electrical, or chemical burns, or with a focus only on burns involving radiation injuries, sunburns, sulfur mustard/other chemical warfare agents/paraquat, studies involving military personnel, mass casualty incidents (MCIs), studies of bacterial isolates from burns, or

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