

RESEARCH ARTICLE

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Burn prevention in the face of global wealth inequality

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Abstract

Background: Burn injuries remain a consistent challenge for providers of medical care worldwide and thus the current focus of medical professionals is on improving treatments and reducing the incidence of burns altogether. We conducted a literature search to summarize worldwide promoted burn prevention strategies.

Methods: A review of the Medline database was conducted using PubMed interface. Abstract screening and full-text analysis of eligible article was performed. Burn prevention strategies were summarized and sorted by origin.

Results: Between 2005 and now, 34 articles regarding burn prevention have been published. Seventy four percent of the articles were published in high income countries, followed by middle income countries with 18 % and low income countries with 9 % of all the manuscripts. The United States published the most articles ($n = 17$), followed by the United Kingdom ($n = 5$), and Iran ($n = 3$).

Conclusions: Although many hardships and barriers need to be overcome, it is more than worthwhile that high income countries should invest a great amount of effort to help low and middle income countries to create strategies to prevent burn injuries, as those burns, which do not occur will always have the best outcome.

Keywords: Burns, Awareness, Prevention, Scald, Flame, Electrical

Background

Burn injuries remain a consistent challenge for providers of medical care worldwide, with approximately 300,000 fatalities and millions of patients affected by long-term consequences of thermal injuries each year. Two general approaches are taken to tackle this problem: improve treatment and reduce the incidence of burns altogether. Means and modalities of burn care and their respective outcomes are continuously improving, resulting for instance in decreased mortality from 6.2 to 3.2 %, shortened length of hospitalization from 13 to 8.6 days and increasing survival rates even for most extensive total body surface area (TBSA) burns over the last two decades in the US [1, 2].

Keynote lectures at the European Burn Conference in 2015 have brought up the discrepancies in the causes of burns depending on the income of the country. Thus

tailored burn prevention strategies are required for each geographical location to ensure a reduction of burns. The WHO, American Burn Association and others have designed burn prevention strategies to accomplish the individual needs of burn prevention.

However, there is no general summary of all those prevention strategies which shows similarities and controversies of each approach. We aimed to conduct a brief literature search to summarize currently available burn prevention strategies and show up which countries are developing those.

Methods

Medical literature was reviewed in order to identify all studies of burn prevention, and burn prevention strategies. A review of the Medline database was conducted using PubMed (accessed 03/01/2016) interface. We limited the search to only articles written in the English language and published between 2005 and now. In addition, the same terms were used for google.com searches to detect further not PubMed listed articles.

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On the PubMed interface, we used the following search terms: (“prevention”[Title] OR “awareness”[Title] AND (“burns”[MeSH Terms] OR “burns”[MeSH Terms] OR “burn”[MeSH Terms] OR “thermal trauma”[MeSH Terms])).

Abstract screening and when appropriate full-text analysis of eligible article was performed and all burn

prevention strategies were summarized in Table 1. Special focus on geographical differences based on the income [3] of the several countries were summarized.

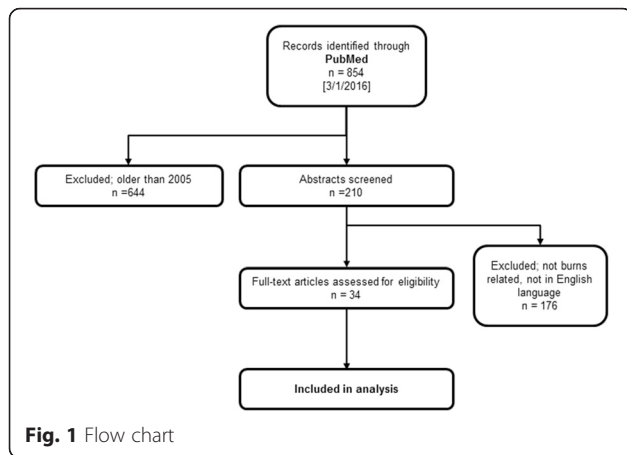
Results

From 854 identified articles in PubMed, 34 were eligible for full-text analysis (Fig. 1). Most burn prevention

Table 1 Summary of recently published burn prevention strategies

Author	Year	Origin	Prevention strategies
D' Cruz et al.	2015	Australia	Use of child-resistant packaging and improved parental practices
Marcucci et al.	2010	Canada	Burn prevention programs for electricians, Safer multimeters with fused leads
Wong et al.	2007	China	Interactive graphical illustrations on burn prevention to educate elderly, their family and caregivers
Unglaub et al.	2005	Germany	Water temperature regulation
Sarma	2011	India	Community seminars and school programs on burn prevention
Ahmadi et al.	2007	Iran	Community-based prevention programs, Use of videos of victim stories
Mohseni et al.	2011	Iran	Television Broadcast of special preventive programs
Rasouli et al.	2015	Iran	Nationwide chemical burn safety education
Peleg et al.	2005	Israel	Establish centralized prevention school programs
Atiyeh et al.	2009	Lebanon	Establish Fire and burn safety education in schools, community awareness programs, legislation and prevention codes
Olaitab and Olaitan	2005	Niger	Fire and cooking safety, no loose clothing
Sadeghi et al.	2011	Sweden	Use of safer consumer appliances, Public health education
Grivna et al.	2014	UAE	Safety education to caregivers, close supervision of young children, occupational safety education
Bayne	2008	UK	Avoid alcoholic skin prep and use occluding drape to prevent fluid spread when using tourniquet
Hodgins et al.	2011	UK	Establish burn prevention programs in low and middle income communities
Kendrick et al.	2012	UK	Use of home safety equipment, Healthcare provider educating patients on burn safety
Durand et al.	2012	UK	Water temperature regulation
Oomman et al.	2013	UK	Public awareness and online learning tools via internet videos
Alden et al.	2005	USA	Burn-injury prevention program for patients and caregiver
Klein et al.	2005	USA	Public education and public service announcements
Cagle et al.	2006	USA	Focused prevention programs to include parent workshops and home visits for environment changes
Alden et al.	2006	USA	Installation and use of safety devices, Educational guidelines for consumers of household items
Forjuoh SN	2006	USA	Environmental modifications, parental education, and Kitchen product redesign and safety
O'Brien et al.	2008	USA	Educate on potential household hazards and cooking safety, Use of child proof devices, Burn prevention programs in schools
Palmieri et al.	2008	USA	Change soup packaging, Educate families with multiple children
Peck et al.	2009	USA	Prevention education, training to health personnel, engineering changes, enforcement of legislative protection and environmental modifications
Leahy et al.	2012	USA	Community based, culturally sensitive programs for senior citizens.
Lloyd et al.	2012	USA	Educate patients and families on burn prevention during well-child visits
Rieman et al.	2012	USA	Burn prevention education in schools
Heard et al.	2013	USA	Establish customized and integrated educational school programs
Heard et al.	2013	USA	Distribute burn prevention coloring books to schools
Lehna et al.	2014	USA	Educate and train health care providers on burn prevention knowledge
Natarajan M	2014	USA	Establish burn education campaign for young women and girls, Safer stove fuel option
Gamelli et al.	2015	USA	Educate caregivers in healthcare settings and establish training programs for daycare workers

UAE United Arab Emirates, UK United Kingdom, USA United States of America



strategies were published in the United States of America and Canada (50 %), followed by the European Union (21 %) and the Middle East (18 %, Fig. 2). Asia was the origin of 6 % of the manuscripts, and 3 % came from Africa as well as Australia. 74 % of the articles were published in high income countries. Whereas middle income countries published 18 % and low income countries 9 % of all the manuscripts. The United States was the country with the most articles published ($n = 17$), followed by the United Kingdom ($n = 5$), and Iran ($n = 3$, Table 1).

Discussion

Our study showed that most of the burn prevention strategies were published in high income countries, which did not necessarily mean that they described burn prevention of those countries. A handful of those studies described prevention strategies for Africa and the Middle East. No prevention strategies were published in South America as well as Russia, which both can be graded as middle income countries [3]. Interestingly, all of the published strategies can be found in the strategies developed

by the WHO (Table 2). Thus we assume that a general approach to prevent burns in LMIC must be provided high income countries, which have already established low incidences of burns and thus can provide knowledge to LMIC.

Prevention efforts have been accompanying these positive developments for decades: by means of education, changes in engineering, adapting and enforcing protective legislature and environmental modifications, the overall incidence of burn injury could be lowered substantially in the US. Limiting water heater temperatures and installment of smoke detectors are two widespread examples of primary prevention [4]. Furthermore governmental and non-governmental agencies are enhancing secondary prevention through educating the public on how to respond to thermal injury ideally when it does occur. Leaflets, social media PSAs and safety instructions at the workplace are only few examples of undertaken measures [5].

For example this year in February, Shriners Hospitals for Children are launching a year-long campaign entitled “Burn Awareness” [6]. In an educational video for children and adults, two comic characters, Boots and Brewster, are leading children through several rooms in a household to point out dangers and to teach how to avoid them. The video can be downloaded for free. In addition, activity books, which are provided in several languages, focusing on burn prevention and awareness can also be ordered via the Shriners Hospitals for Children homepage.

As encouraging as these accomplishments are, one must be mindful that they have only been achieved for developed high-income countries (HIC) such as the US and most countries of Europe. However, 95 % of annual burn injuries occur in countries of low and middle income (LMIC), where mortality rates are up to 10 times higher than in their high income counterparts [7]. In a joint effort to improve this situation, the World Health Organization (WHO) and the International Society for Burn Injuries (ISBI) launched “A WHO plan for burn

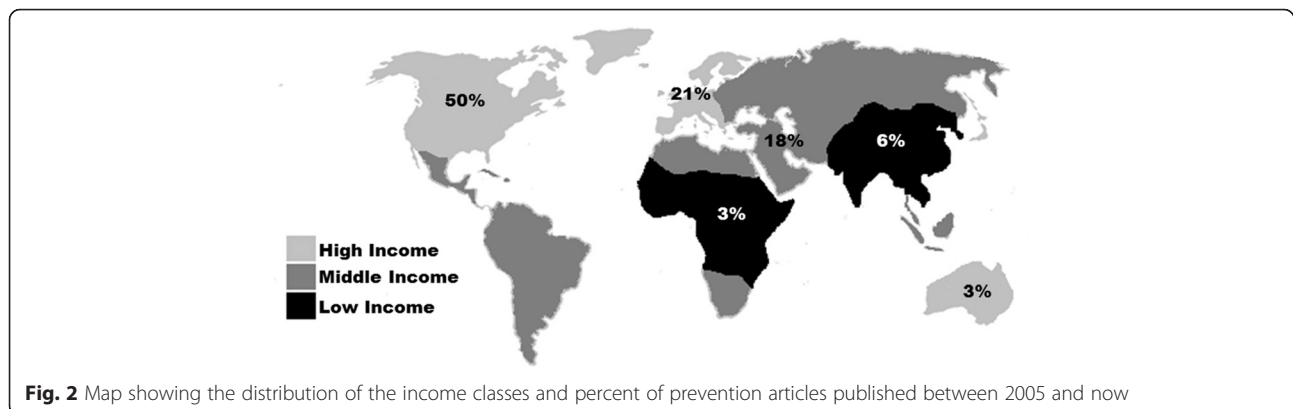


Table 2 Burn preventions strategies adapted from the WHO [10]

Prevention	Background	Solution
<i>Fire detection systems and sprinkler</i>	House fires are still a major cause of burns and inhalation injuries.	Fire detection devices (based on smoke detection) and sprinklers should be mandatory for all new buildings.
<i>Temperature regulation on hot water heater</i>	In children, scald burns are more common than flame burns.	To lower the set temperature of water heaters to roughly 50 °C (~120 °F).
<i>Nonflammable fabrics</i>	Clothes can easily catch fire, especially from contact with open fire (cigarettes, candles) or stoves.	The use of nonflammable sleepwear especially for children and toddlers.
<i>Electrical safety</i>	Electrical burns are the most severe type of burns and usually result in severe sequelae.	To ensure that electricity is used and delivered safely. Techniques for safety such as adequate insulation are necessary.
<i>Fire-Safe-Cigarettes</i>	Fire from tobacco products are also a leading cause for burn injuries worldwide.	Ideally, stop the use of tobacco and smoking would be the best prevention. However, stopping indoor smoking is a step forward.
<i>Safer fireworks</i>	Burns from fireworks are a problem of both, high- and middle-income countries.	The purchase and use of fireworks needs to be more strictly regulated.
<i>Safer stoves and lamps</i>	Even nowadays, many households in middle- and low-income countries use open fires for daily cooking.	The goal is to create a safer methods for daily cooking in those countries. New type of stoves and lamps are part of ongoing developments.
<i>Combating acid-throwing</i>	The throwing of acids on faces leading in severe damage and disfigurement has become very popular.	Prevent the disposal of acids as well as the prevention of violence are the main goals to prevent those chemical burns.

prevention and care” in 2008, a 10-year prospective program designed to reduce thermal injury risks and standardize fundamental principles of burn treatment in LMIC [7].

Key goals of the program are to raise awareness for burn related problems, influence policies, regulations, legislation and their enforcement and to develop prevention programs and national burn strategies. The potential of preventive measures cannot be overrated in terms of cost-effectiveness, as there has been convincing data from the US which demonstrated manifold savings in health expenditure for every dollar spent on preventive measures [8]. With this in mind, a great deal of WHO’s prevention measures for LMIC target the same objectives as in HIC (smoke detectors, hot water temperature regulation, safety regulations for electric wiring, etc.). On the contrary, other risk factors are unique to the conditions in underdeveloped regions such as cooking with open fire, pots on ground level, use of kerosene lamps and easily ignitable loose clothing and thus need to be addressed specifically.

Another important aim of the WHO plan is to improve and standardize treatment for burn injuries. This is not only limited to acute care in specialized hospitals, but also includes educating the public on how to correctly react immediately after a burn occurs. Measures that are already widely taught in HIC through government and non-government agencies, such as immediate cooling, removing all clothing from the burned area and applying dry cloth while avoiding any creams, ointments or home remedies, are supposed to be introduced in

LMIC as well. An encouraging large cohort study was recently published out of Shanghai, where the percentage of patients who had been educated on these effective methods via traditional media, internet or workplace education had a significantly better outcome across all types of burn injuries [9].

The current research has several limitations. The time-frame, 2005 up to now, as well as the use of PubMed only are definitively limitations of the study. We further included articles which have been published in English and thus our calculations regarding the origin of the prevention strategies might have been biased.

Lastly, a key goal of the WHO plan is to collect research data in an organized and comprehensive manner in order to validate the effectiveness of the undertaken efforts, as well as to provide valuable insights for the research community and future improvement of treatment and prevention programs [7].

Conclusions

Although many hardships and barriers need to be overcome, it is more than worthwhile that high income countries should invest a great amount of effort to help LMIC to create strategies to prevent burn injuries, as those burns, which do not occur will always have the best outcome.

Competing interests

The authors declare that they have no competing interests.

Authors’ contributions

All authors read and approved the final manuscript.

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