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Fires in refugee and displaced persons settlements: the current situation and opportunities to improve fire prevention and control

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Abstract

Introduction—We aimed to describe the burden of fires in displaced persons settlements and identify interventions/innovations that might address gaps in current humanitarian guidelines.

Methods—We performed a systematic review of: i) academic and non-academic literature databases; and ii) guidelines from leading humanitarian agencies/initiatives regarding fire prevention/control.

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Results—Of the 1,521 records retrieved, 131 reports described settlement fires in 31 hosting countries since 1990. These incidents resulted in 487 deaths, 790 burn injuries, displacement of 382,486 individuals and destruction of 50,509 shelters. There was a 25-fold increase in the rate of settlement fires from 1990 to 2015 (0.002 to 0.051 per 100,000 refugees, respectively). Only 4 of the 15 leading humanitarian agencies provided recommendations about fire prevention/control strategies. Potentially useful interventions/innovations included safer stoves (e.g. solar cookers) and fire retardant shelter materials.

Conclusion—The large and increasing number of fires in displaced persons settlements highlights the need to redress gaps in humanitarian fire prevention/control guidelines. The way forward includes: i) developing consensus among aid agencies regarding fire prevention/control strategies; ii) evaluating the impact of interventions/innovations on the burden of fires; and iii) engaging agencies in a broader discussion about protecting camp residents from armed groups.

Keywords

refugee; displaced person; fire; burn; injury prevention

Introduction

There are nearly 60 million displaced persons worldwide [1]. Ongoing conflict in the Syrian Arab Republic, Central African Republic, South Sudan and Iraq have caused a 40% increase in the number of displaced persons over the past 3 years; 14 million persons were displaced in 2014 alone [1]. The large and rapid increase in the number of displaced persons has strained humanitarian agencies' ability to plan, organize and maintain formal and informal settlements [1]. As a result, the safety of many encamped persons has become jeopardized [2]. Therefore, comprehensive, cost-effective and evidenced-based guidelines are needed to support efforts that promote the safety, health and well-being of encamped displaced populations worldwide.

Injury is one of the most common causes of death and disability among individuals in low- and middle-income countries [4–6]. Displaced persons are more vulnerable to burn injuries than their non-displaced counterparts due to living in overcrowded temporary structures, using unsafe cooking and heating appliances or open fires, inability to provide constant childhood supervision, and more predisposed to assault by domestic partners, criminals and armed groups [7–11]. Therefore, fire prevention and control initiatives are particularly important in camp settings. However, inter-agency humanitarian camp management guidelines regarding fire prevention and control are incommensurate with the risks faced by displaced persons, including those from The Sphere Project [12].

Inadequate fire guidelines are due, in part, to the lack of estimates of the burden of fire-related injuries or structure loss in humanitarian settings. Additionally, many settlements are not designed and/or equipped with contextually appropriate fire prevention and control strategies in mind. To address these gaps, we aimed to: describe the burden of fires in humanitarian settlements using a systematic lay-literature search; report current fire prevention and control policies from leading humanitarian agencies' guidelines; and identify gaps between the guidelines and published fire prevention and control interventions and

innovations in comparable settings. By doing so, the findings might highlight the burden of fires on camp health and infrastructure, as well as the need to modify humanitarian agency guidelines to include interventions and innovations that might improve fire prevention and control in camp settings.

Methods

The review consisted of three searches that aimed to describe the problem, review current standards, and identify potential interventions or innovations that might reduce the burden of fires in humanitarian settlements. Specifically, the searches consisted of a:

1. Systematic review of fires in refugee and displaced person settlements;
2. Targeted review of the 15 leading humanitarian agencies fire prevention and control guidelines; and a
3. Systematic review of fire prevention or control interventions or innovations potentially useful for displaced person settlements.

Searches 1 and 3 were performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. [13]

Search 1 – describing the problem

We performed a systematic search of PubMed, LexisNexis, Google and humanitarian news wires (i.e. Integrated Regional Information Networks [IRIN], AlertNet by Thompson Reuters Foundation) to retrieve reports of fires in humanitarian settlements. Each search used database-specific language and was inclusive, such as (“Refugee” OR “Displaced”) AND (“Fire” OR “Burn”) (Appendix).

Reports that documented a fire of any cause (e.g. household accident, natural causes, arson) in a humanitarian camp were included. Reports that documented a fire caused by mobs, military forces, armed groups, governments or other organizations were also included. Conversely, fires caused by an airstrike or bombardments were excluded given the potential difficultly comparing prevention and control strategies for aerial mechanisms with those that cause ground fires. Reports were also excluded if they described fires that were not in humanitarian settlements (e.g. fires that occurred in urban slums inhabited by displaced persons). Only English-language reports and reports pre-translated by the database host were reviewed.

Retrieved records (i.e. titles and abstracts) were screened for inclusion. Duplicate records and reports of the same fire from a different news or humanitarian agency were removed. Full-text reports of included records were examined. The following data were extracted and described:

- Year of fire;
- Country and camp;
- Assumed cause of and/or party responsible for fire (e.g. unintentional, intentional, armed group);

- Number of burn injuries and/or deaths;
- Number of displaced persons due to the fire; and
- Number of structures destroyed.

For a report that described the number of families affected by the fire (i.e. not individuals), an estimate of the number of affected individuals was made by multiplying the average household size of the country of origin by the number of families affected. Average household size was determined by results of the most recent national or camp census. This method has been validated for estimating household size in humanitarian settings [15].

If a report described the number of individuals displaced by the fire but did not mention the number of burned structures, an estimation of the number of burned structures was made by dividing the number of displaced persons by the average household size determined as above.

Vague data (e.g. *many* shelters, *hundreds* of shelters, *thousands* of persons displaced) were coded as missing to avoid overestimation. Overall, 48% of retrieved reports did not mention or provided vague information about the number of deaths; 66% for burn injuries; 16% for burned shelters; and 19% for displaced persons.

Estimates of the number of displaced persons per year since 1990 globally were obtained from Global Humanitarian Assistance Reports to calculate the rate of camp fires per 100,000 displaced persons [14].

Search 2 – current guidelines for fire prevention and control in humanitarian settlements

Settlement management and/or shelter guidelines from 15 of the leading humanitarian agencies or initiatives were purposively sampled to define current recommendations for fire prevention and control in camp settings. Leading agencies were identified by the Global Humanitarian Assistance Report 2013 and author experience [14]. The agencies or initiatives included: The Sphere Project, The United Nations High Commissioner for Refugees (UNHCR), United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), International Committee of the Red Cross (ICRC), United States Agency for International Development (USAID), United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA), International Organization for Migration (IOM), Shelter Centre, Norwegian Refugee Council (NRC), International Rescue Committee (IRC), Disaster and Emergency Management Presidency (AFAD), Refugees International, International Fire and Security Exhibition and Conference Global (IFSEC Global), United Kindom Overseas Development Institute (ODI), and E-shelter.

Camp management and/or shelter guidelines for each agency or initiative were downloaded from their respective website and reviewed. Within each guideline, a search for the words, ‘fire’ and ‘burn’ was performed. All pertinent verbiage was extracted and described.

Search 3 – identifying other fire prevention or control interventions or innovations

Lastly, we systematically searched PubMed, Google Scholar, Google and LexisNexis for interventions or innovations that were developed for preventing or controlling fires in

humanitarian or commensurate settings (e.g. villages, urban slums) using database-specific search language. Terms for setting (e.g. ‘refugees,’ ‘settlement,’ ‘shelter,’ etc.), fire prevention and control (e.g. ‘fire,’ ‘prevention,’ ‘safety,’ etc.) and relevant risks, actions, interventions or innovations (e.g. ‘extinguish,’ ‘detector,’ ‘retardant,’ ‘fuel,’ ‘stove,’ etc.) were included (Appendix). Records were screened for relevance and the full-text of each included report was reviewed. References of each included report were also reviewed for useful records. Potentially useful interventions or innovations were extracted and described.

Results

Search 1- Describing the problem

The search of LexisNexis database returned 1,521 records (Figure 1). Of these, there were 285 duplicates or reports that described the same fire (26% of retrieved records from LexisNexis). One hundred and thirty-one reports described at least one fire in a displaced persons camp and were included in this study (12% of retrieved records from LexisNexis). The search of PubMed database returned 48 reports. Three potentially useful records were evaluated in full-text (6% of retrieved records from PubMed); none met inclusion criteria. Searches of Google, IRIN and AlertNet returned 495 records. Of these, 11 reported fire incidents not described by reports retrieved from LexisNexis (2.2% of records from Google, IRIN and AlerNet).

There were 131 fire incidents in displaced persons settlements in 31 countries since 1990 (Figure 2). There was a 25-fold increase in the rate of camp fires from 1990 to 2015 (0.002 to 0.051 per 100,000 refugees, respectively) (Figure 3). Fires in displaced persons settlements have resulted in 487 deaths and 790 burn injuries. Further, 382,486 individuals have been displaced and 50,509 shelters destroyed from camp fires.

Thirty-six fires were reported to be unintentional (i.e. fires caused by cooking, fuel explosions, heat sources, electrical malfunctions; 27% of reported fire incidents), 26 were intentional (20%) and 43 had an unknown cause (33%). Twenty-six reports did not mention a cause for the fire (20% of reported fire incidents). Intentional fires were responsible for the largest number of reported deaths (329 deaths; 68% of deaths), burn injuries (359 burn injuries; 45% of burn injuries), destroyed shelters (16,142 shelters; 32% of destroyed shelters) and displaced persons (139,498 individuals; 36% of displaced individuals).

Fires that occurred in settlements in two countries, Sudan and Uganda, comprised a substantial proportion of the retrieved reports. Further, the causes of fires in each country differ, which has implications for prevention and control. Thus, instructive differences are described.

Camp fires in Sudan—Thirty-five reports described fires in displaced persons settlements in Sudan (27% of all retrieved reports), namely those that occurred in Darfur. These fires resulted in 89 deaths, 272 burn injuries, destruction of 6,308 shelters and displacement of 89,282 persons. Almost a third of reported fires in Sudan were caused by an armed group (11 fires; 31% of fires in Sudan); 5 fires were caused by household accidents or natural causes (17%). The reports documented serial acts of violence perpetrated by armed

groups, government military forces and the Janjaweed militia against encamped displaced persons [16–18]. Similarly, reports described that many destroyed shelters have not been reconstructed in efforts to compel displaced persons to resettle in their original towns or villages [19–21]. Thus, fire-displaced individuals are forced to live in the open without shelter, food, supplies or protection [20–22].

Camp fires in Uganda—There were 19 reported fires in displaced person settlements in Uganda. Compared to the other countries, fires in displaced persons settlements in Uganda led to a high proportion of death and displacement. Between 2004 and 2008 alone, fires in Ugandan settlements resulted in 224 deaths and displacement of 21,142 individuals. Unlike Sudan, only 2 fires were reported to have been perpetrated by armed groups (e.g. the Lord's Resistance Army; 11% of camp fires in Uganda) [23, 24]. Instead, 17 of the 19 fires were due to unintentional (e.g. household causes) or natural causes (e.g. brush fire, lightening) (89%).

Search 2 – current guidelines for fire prevention and control in humanitarian settlements

Of the reviewed leading humanitarian agencies and initiatives, only The Sphere Project, UNHCR, USAID and NRC provided specific guidelines regarding fire prevention and/or control for displaced person settlements (Tables 1 – 4).

Examples of fire prevention guidelines from the aforementioned agencies or initiatives include:

- Ensure firebreaks between neighboring shelters (e.g. 30 meters between every 300 meters of built up area) and separate shelters by at least twice the total height of each structure
- Recommend candles be used within glass jars;
- Perform regular inspection of electrical wiring;
- Apply fire retardants to thatch roofs; and
- Provide sufficient blankets and plastic sheeting to minimize heater use.

Due to variability in the availability of different building materials in various locations, the guidelines are generally non-specific with regards to shelter structure codes.

The guidelines also provide several fire control and first aid recommendations, such as:

- Provide fire stations with buckets with small holes to reduce risk of theft, as well as sand, fire beaters and fire extinguishers;
- Have a fire-bell alert system; and
- Teach the, 'Stop, Drop and Roll' technique to camp residents.

Despite the recommendations, no successful examples or specific guidelines on development and maintenance of these essential fire control strategies are provided.

Search 3 –other fire prevention or control interventions or innovations

The PubMed search for innovations and interventions regarding fire safety resulted in 158 articles, 16 of which were fully reviewed and none was included in our analysis. Together, searches of the LexisNexis Academic database and Google returned 8 reports that described innovations for fire prevention or control in humanitarian camp settings. Five of these reports described more efficient, safe and/or reliable cooking stoves, including stoves powered by solar energy converted to heat instead of flame (Table 5). Other innovations included:

- a stove that charges appliances;
- solar lighting; and
- flame retardant tarpaulins for shelters.

Most of these innovations are low-cost (i.e. less than US $14 per household). Despite several potentially useful innovations for preventing fires, none of these have been studied with regard to fire prevention. In addition, our searches did not return reports that described effective ways to develop, implement or maintain interventions like smoke detection or fire alerts, local extinguishing mechanisms, or fire services.

Discussion

In this review, we aimed to describe the burden of fires in humanitarian settlements, report current fire prevention and control guidelines, and identify gaps between the guidelines and published fire prevention and control initiatives and innovations. By doing so, we have provided a gross estimate of the burden of humanitarian camp fires and identified ways in which humanitarian agencies might improve fire prevention and control in camp settings. Since 1990, humanitarian camp fires have resulted in at least 480 deaths and 790 burn injuries. Additionally, camp fires have destroyed more than 50,000 shelters and caused 380,000 individuals to be displaced again. Further, the rate of camp fires is increasing dramatically. While several leading humanitarian agencies offer fire prevention and/or control strategies, current guidelines are not comprehensive and many agencies do not provide any fire prevention or control recommendations. In addition to redressing current guideline deficiencies, agencies might consider several other innovations (e.g. safer stoves, solar powered lighting, fire retardant shelter materials) to reduce the risk and impact of fires. Lastly, there is a paucity of fire prevention and control evidence for interventions that encompass fire detection, alerting and extinguishing in humanitarian settings, which presents an opportunity for improving the safety of camp residents worldwide.

A comparison of data from similar studies is not possible given the lack of published evidence. However, discussion of some of the lessons from retrieved reports is useful. Most reported fires were unintentional (i.e. cooking, fuel explosions, heat sources, electrical malfunctions). Many of these fires could be prevented by having camp residents store fuels more safely, routinely examine electrical wiring, not leave fires or stoves unattended and extinguish flames and embers after use. Successful implementation of such strategies would require considerable resident sensitization to household fire safety strategies and provision of basic resources (e.g. jerry cans, safe stoves).

Other causes of fire included attacks from armed groups. Although aid agencies may have difficulty preventing intentional fires, the frequency and impact of arson by armed groups demonstrated by this study should spark discussion about fire and camp safety more broadly. The effect of intentional fires could be mitigated by developing and following guidelines that reduce the spread of fire between structures (e.g. firebreaks, control of shelter density), and lead to a faster and more effective response to fires (e.g. simple alert systems, volunteer fire service, regularly spaced water or sand buckets). Given that displaced persons often settle at a site before an aid organization can plan camp design (e.g. shelter spacing) and distribute safe supplies, interventions that do not rely on redesigning the settlements' layout may be of particular importance and should be part of initial efforts to establish a safe camp environment [25]. Furthermore, if fire retardant shelter materials cannot be provided to displaced persons initially, they should be distributed later as shelter materials wear and require replacement.

Most of the innovations retrieved from our search were designed to increase the safety and/or fuel efficiency of stoves. Encamped households commonly use open fires for cooking [26–30]. However, such stoves are not fuel efficient (i.e. waste heat, require more fuel and longer burning times), increase deforestation, typically require women and girls to travel unprotected for long distances out of the camp to collect wood, and increase the risk of fire [26–30]. In addition to potentially preventing fires, newer stoves offer broader benefits (e.g. use of more clean energy, less smoke inhalation, promotion of gender equality) [26–30]. Additionally, reducing excessive deforestation and fuel competition might help alleviate the tension between the camp settlers and the original residents of the region, which may help to prevent arson or other violent acts against camp residents.

Agencies should consider taking advantage of low-cost, safer and effective innovations that improve and make the lives of camp residents safer. For instance, recently developed portable, water-resistant solar-powered LED lanterns are safer and more fuel-efficient than kerosene lamps or candles [31]. In the past, solar cookers were not popular amongst camp residents due to their bulkiness, difficult assembly and length of cooking time; fortunately, newer models are easy to assemble, efficient, lightweight, and portable [30]. Evaluation of one of these models was well accepted in two settlements in Kenya, Dadaab and Kakuma [30]. However, manufacturers have faced significant challenges in bringing such technology to the humanitarian sector [31]. For this reason, the creation of an open-access database of current innovations and the available evidence for their use might help to introduce affordable and potentially useful products to humanitarian agencies. Similar databases have been used successfully by other sectors (e.g. mining, health information technology) [32].

Given the frequency of camp fires found in our review, humanitarian agencies should establish and follow guidelines for alarm and fire control systems that consider camp layouts and the resources available within them. Alarm and aid stations should be predictably situated throughout the camp to allow equitable and rapid access for camp residents. In settlements at high-risk of violence from armed groups, agencies might consider different types of alarms for raids and/or intentional fires or unintentional ones so that proper safety and fire response plans can be followed. Camp residents should be educated about the meaning of and the appropriate response to each alarm. Camp residents should be

encouraged to keep a bucket of water or sand in their shelter at all times in case of fire [33]. Willing camp residents might be organized and comprise a voluntary fire service. As with volunteer fire services in rural areas in developed countries, training should include safe rescue, first-aid, context-appropriate extinguishing methods, preventing fire spread, damage assessment and reporting, and fire safety education [34, 35].

This is the only review to offer a gross estimate of burn injury morbidity, mortality and shelter loss burden of humanitarian camp fires and ways in which they can be prevented or controlled. However, several study limitations are worth mention. First, the figures presented represent a bare minimum estimate of the burden of humanitarian camp fires given the extreme risk of publication bias [36]. Fires might be more likely to occur in remote settlements, recently created informal settlements, or settlements in areas that are not considered politically relevant (e.g. Bududuram camp in Ghana). Similarly, settlements that are located where the security situation prevents media coverage or where the media are not allowed may not receive equitable coverage of fire reporting (e.g. informal displaced persons settlements in Syria; refugee settlements in Yunnan, China). Moreover, the number of fire-related deaths reported by included studies did not systematically follow patients after initial injury. Given the critically limited burn care capacity in humanitarian settings, many of the injured may ultimately have died. Second, minor fires, burn or inhalational injuries or carbon monoxide poisoning incidents that represent near misses were less likely to be reported than major ones and likely missed in this review. Nonetheless, individual burns or structure fires constitute a significant global public health burden, particularly for those living in LMICs regardless of the level of internal crisis [6]. Third, the search of news articles was limited to those written in the English language. This may be of particular importance for reports by freelance journalists and news agencies that cover francophone Africa, South America and Southeast Asia. This limitation again underscores the conservative nature of the figures presented. Next, we did not include reports of fires in urban settings inhabited predominantly by displaced persons. Urban settings are increasingly common locations for displaced persons to settle [37]. However, fire prevention and control in these areas likely require strategies unique from those in camp settings and were beyond the scope of this review. Lastly, the review of the lay literature was performed using the LexisNexis Academic database. Although this is the largest database of news reports and periodicals available, lesser-known publications from LMICs may not be well represented. To mitigate the effect of this potential limitation, we specifically searched humanitarian news wires (e.g. IRIN, AlertNet), which would be more likely to cover fires in displaced persons settlements than major media outlets. Despite these limitations, reasonable conclusions can be drawn regarding the significant burden of fires in humanitarian settings, shortcomings in camp guidelines and ways in which fire prevention and control strategies can be improved.

Conclusion

With the large and increasing number of displaced persons globally, fires in humanitarian settlements pose a constant threat to residents. The frequency and resultant shelter destruction and displacement related to humanitarian camp fires found by this review highlights gaps in the current fire control and prevention guidelines offered by leading humanitarian agencies. Future steps to promote fire safety in humanitarian settlements

include: i) developing and disseminating consensus regarding fire-related guidelines among humanitarian stakeholders; ii) evaluating the impact of interventions and innovations on fire prevention and control; and iii) encouraging the development of other context-appropriate interventions. Lastly, humanitarian agencies should engage in a broader discussion about camp safety, particularly with regards to protecting residents from armed groups. By implementing better fire control and prevention guidelines, humanitarian agencies might reduce the incidence of fire and burn injuries among camp residents and prevent the potentially devastating health and social burden associated with them.

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Appendix

Search 1- Describing the problem

The following language was used to search for the fire or burn incidents in displaced persons settlements in LexisNexis data base and PubMed

(“Refugee” OR “Displaced”) AND (“Fire” OR “Burn”)

Search 3 –other fire prevention or control interventions or innovations

The following language was used to search for fire prevention or control interventions or innovations in PubMed.

(“Refugees”[Mesh] OR “Internally Displaced”[Tiab] OR “Settlement”[Tiab] OR “Shelter”[Tiab]) AND (“Accident Prevention”[Mesh] OR ((“Wounds and Injuries”[Mesh] OR “Burns”[Mesh]) AND (“Prevention and Control”[Subheading])) OR “Fire Safety”[Tiab] OR “Fire Prevention”[Tiab] OR “Fire Control”[Tiab] OR “Fires”[Mesh] OR “Fire Extinguishing Systems”[Mesh] OR “Firefighters”[Mesh] OR “Flame Retardants”[Mesh] OR “Smoke Detector”[Tiab] OR “Fuel Oils”[Mesh] OR “Kerosene”[Mesh] OR “Charcoal”[Mesh] OR “Cooking”[Mesh] OR “Stove”[Tiab])

The following language was used to search for fire prevention or control interventions or innovations in other databases.

(“Refugees” OR “Internally Displaced” OR “Settlement” OR “Shelter”) AND (“Accident Prevention” OR “Wounds and Injuries” OR “Burns”) AND (“Prevention and Control” OR “Fire Safety” OR “Fire Prevention” OR “Fire Control” OR “Fires” OR “Fire Extinguishing Systems” OR “Firefighters” OR “Flame Retardants” OR “Smoke Detector” OR “Fuel Oils” OR “Kerosene” OR “Charcoal” OR “Cooking” OR “Stove”)

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Highlights

- Fires in humanitarian camps are a significant and increasingly common problem
- Humanitarian agencies do not have fire safety guidelines commiserate with fire risk
- Several innovations could prevent/control camp fires (e.g. safer stoves, fire retardant tarpaulins)

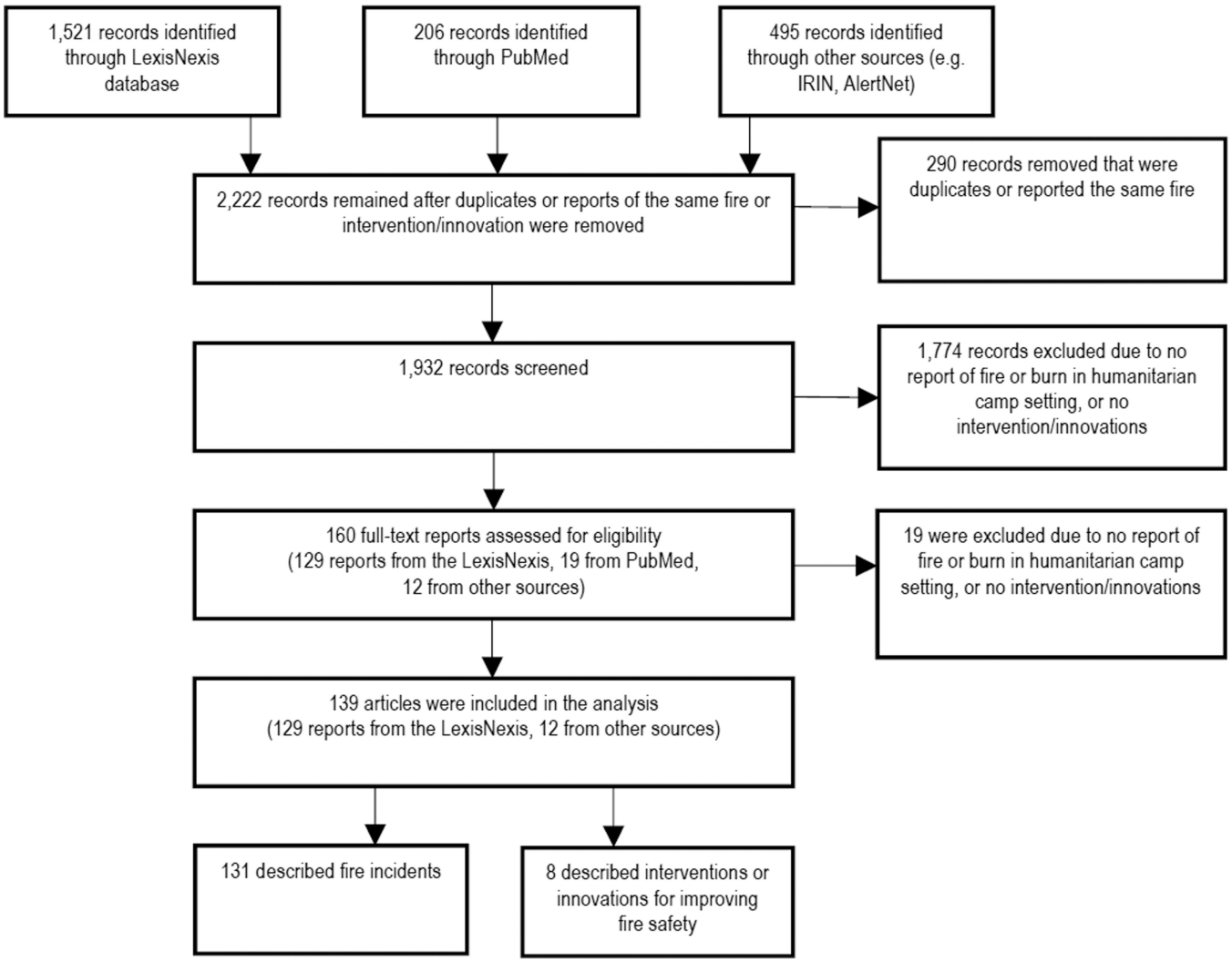

Figure 1.

Combined flow diagram for searches aimed to describe the burden of humanitarian camp fires and potential interventions/innovations for improving fire prevention or control.

IRIN - Integrated Regional Information Network

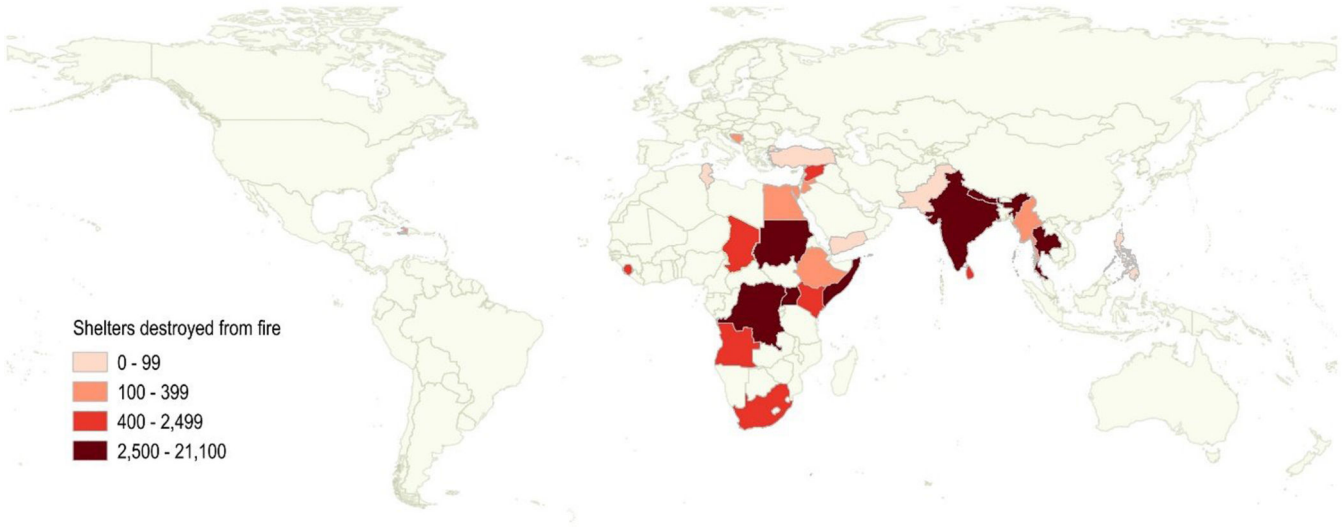

Figure 2.

Map of countries where fires have destroyed shelters in displaced persons camp since 1990. Orange (0–99 shelters) includes Afghanistan, Bosnia-Hercegovina, Egypt, Ethiopia, Gaza, Ivory Coast, Jordan, Lebanon, Pakistan, Philippines, Singapore, Tunisia, Turkey, Yemen and Zembabwe; Red (100–399 shelters) includes Angola, Burma, Haiti, South Africa and Syria; Dark red (400–2,499 shelters) includes Chad, India, Kenya, Sierra Leonean, Sri Lanka and Thailand; Very dark red (2,500–21,100) Democratic Republic of Congo, Nepal, Somalia, Sudan, and Uganda.

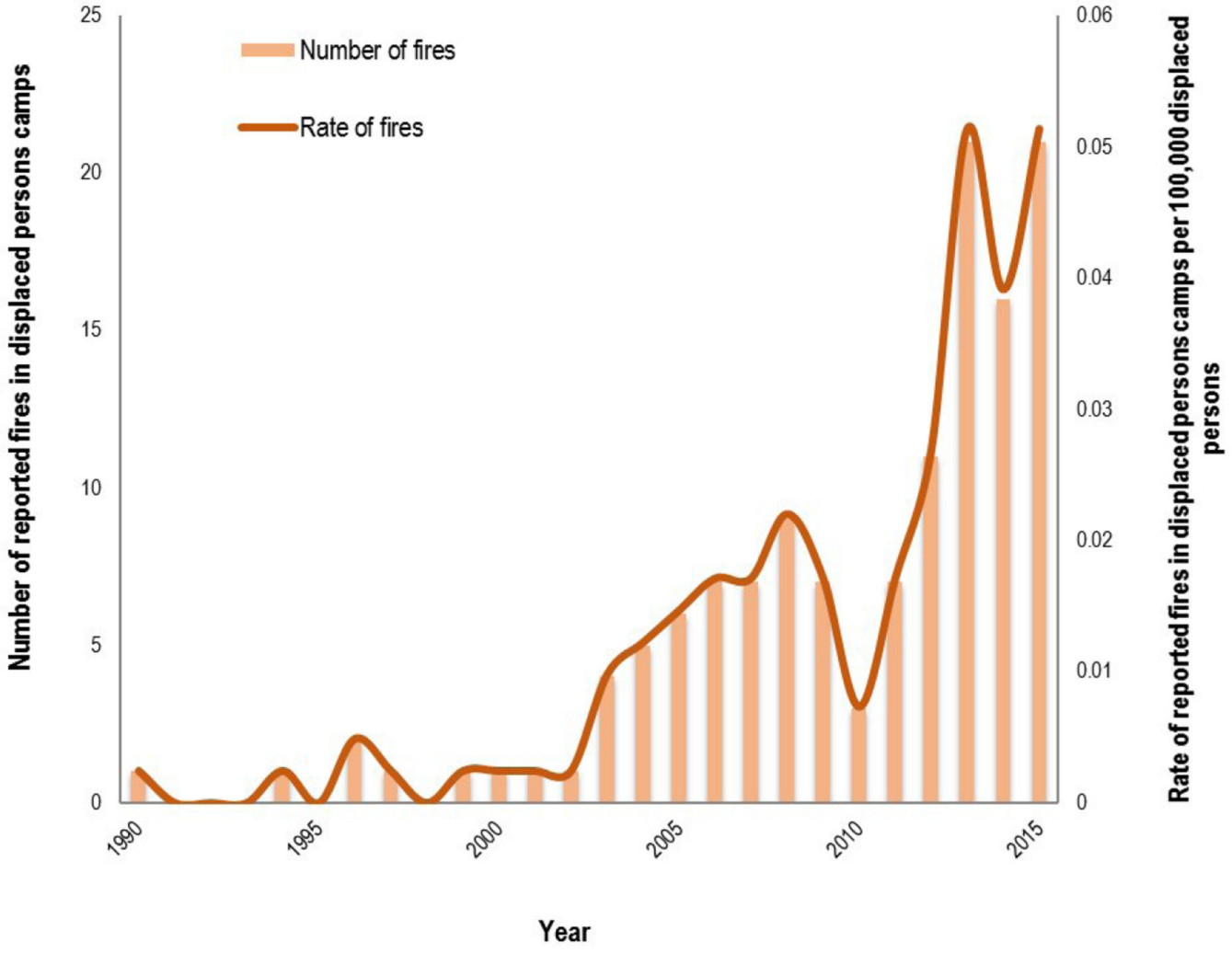

Figure 3.
Number and rate of fires in displaced persons settlements worldwide since 1990.

Table 1

Specific site planning guidelines regarding fire prevention or control from leading humanitarian agencies.

Agency or initiative	Guidelines	
Sphere Project	•	Assess fire risks to inform the site planning of temporary communal settlements and the grouping of individual household shelters.
Sphere Project; UNHCR	•	Provision of a 30 m firebreak between every 300 m of built-up area, and a minimum of 2 m (but preferably twice the overall height of any structure) between individual buildings or shelters to prevent collapsing structures from touching adjacent buildings.
NRC	•	Sites should have regular firebreaks
	•	Shelters should ideally be spaced at a minimum of twice their height apart
USAID	•	Proper spacing and arrangement of all buildings to provide firebreaks
	•	Minimum shelter space of 3.5 m^2/person
	•	Minimum total site area of 45 m^2/person for temporary planned or self-settled settlements
UNHCR	•	There should be a bare minimum figure of 30 m^2 surface area per person.[1]
	•	Firebreak (area with no buildings) 30 m wide is recommended for approximately every 300 m of built-up area. In modular settlements, firebreaks should be situated between blocks.
	•	If space allows, the distance between structures should be a minimum of twice the overall height of any structure. If building materials are highly inflammable (straw, thatch, etc.) the distance should be increased to 3 to 4 times the overall height.[2]

UNHCR – United Nations High Commissioner for Refugees; NRC – Norwegian Refugee Council; USAID – United States Agency for International Development;

[1] Includes the area necessary for roads, foot paths, educational facilities, sanitation, security, firebreaks, administration, water storage, distribution, markets, relief item storage and, of course, plots for shelter. The figure of 30 m^2 does not include, however, any land for significant agricultural activities or livestock.

[2] The direction of any prevailing wind will also be an important consideration.

Table 2

Specific shelter guidelines regarding fire prevention or control from leading humanitarian agencies.

Organization	Guideline
Sphere Project	• Energy-efficient cooking practices should be promoted, including the use of fuel-efficient stoves, firewood preparation, fire management, food preparation, shared cooking, etc.
	• In communal accommodation, common or centralized cooking facilities are preferable to the provision of individual household stoves, to minimize fire risks and indoor smoke pollution
	• Safe separation should be ensured between the stove and the elements of the shelter.
	• Internal stoves should be placed on a non-flammable base with a non-flammable sleeve around the flue where it passes through the structure of the shelter to the exterior.
	• Stoves should be located away from entrances and placed to enable safe access during use.
	• The fire risk of using lanterns or candles should be assessed. Provide other types of artificial lighting to contribute to personal safety in and around settlements where general illumination is not available.
	• The use of energy-efficient artificial lighting should be considered, such as light-emitting diodes (LEDs), and the provision of solar panels to generate localized electrical energy.
	• Ensure that fuel is sourced and stored in a safe and secure manner
NRC	• Prohibit open fires or bare flames inside shelters unless in a well-contained area – please note that national policies on this may vary
	• Regulate when cooking fires are allowed in dry seasons
	• Ensure candles – if allowed in the camp – are placed in lamps or in jars
	• Remind camp residents to never leave a candle lit while sleeping or when they leave the shelter
	• Provide sensitization training on the risks associated with smoking inside or near shelters
	• Ensure stoves do not touch or adjoin flammable walls
	• Ensure chimneys project through a solid wall or through a fireproof plate
	• Ensure electric light bulbs are at least 20 cm from tent canvas or other flammable materials
	• Regularly inspect electrical wiring.
USAID	• Allow individual fires for cooking only and building fires outdoors only, if possible
	• If cooking must take place indoors, and especially in wooden or wattle-and- daub buildings, the cooking area should be protected with fire-resistant sheeting if possible
	• If large-scale cooking takes place indoors (e.g., in a supplementary feeding center), fire-resistant ceilings and walls are mandatory
	• Fire retardants can be applied to thatched roofs in dwellings
	• Proper precaution must be taken when storing and using fuels
	• Highly flammable synthetic materials should be avoided
UNHCR	• In addition to shelter, provision of sufficient blankets, mattresses, additional plastic sheeting and provision of heaters will be a high priority.
	• Fire prevention measures should be established when providing heaters and it is thus necessary to deal with the procurement, storage, and/or distribution of fuel.

NRC – Norwegian Refugee Council; UNHCR – United Nations High Commissioner for Refugees; USAID – United States Agency for International Development

Table 3

Specific camp preparedness guidelines regarding fire prevention or control from leading humanitarian agencies.

Organization	Guidelines
NRC	• Provide fire stations with buckets (with small holes to reduce risk of theft); sand, fire beaters and fire extinguishers
	• Note that spraying water will only cause kerosene fires to spread
	• Provide a fire-bell to alert other camp residents to large fire outbreaks
	• Set up community fire committees to train camp residents on preventing and dealing with fires
	• Enforce fire breaks and keep them free of debris, and ensure fire stations are equipped to help deal with fires
USAID	• An alarm system, firefighting teams, and beaters must be organized in advance

NRC – Norwegian Refugee Council; USAID – United States Agency for International Development

Table 4

Specific guidelines regarding fire control and burn first aid from leading humanitarian agenc

Organization	Guidelines
NRC	• Check that there is no-one inside the shelter/tent and only then knock it down to help prevent the fire from spreading
	• Remember to teach camp residents the “stop, drop and roll technique” – if your clothes are on fire, stop where you are, drop to the ground and roll to extinguish the flames.
	• If you do get burn casualties:
	– Cool the affected area with cold water or a wet towel immediately;
	– Protect the burn with a clean cloth;
	– Seek medical help as soon as possible; and
	– Keep burn victims warm.
USAID; UNHCR	• Water is generally not available in sufficient quantities or at adequate pressure for the control of major fires; however, sand or other loose mineral soil material can be an effective method of control.
USAID	• A new firebreak should be created by taking structures down manually or with a bulldozer if available.

NRC – Norwegian Refugee Council; UNHCR – United Nations High Commissioner for Refugees; USAID – United States Agency for International Development

Table 5

Design, importance, distribution and cost of various innovations for fire and burn prevention in displaced persons settlements.

Innovation	Design	Importance	Distribution	Cost (US$)
Stove	Sheet-metal wrap around fuel source, prevents convection heat loss	More fuel efficient compared to three-stone fires		$10 per unit
Stove	Stove wraps around the pot or kettle	90% more fuel efficient; outside of stove is not hot		$14 for a small family stove
Stove	Concentrates heat inside a metal cylinder up toward the cooking pot; fire off of the ground, allowing air to flow beneath it and increasing the efficiency of the fuel	More fuel efficient; can be assembled by hand	More than 3,000 units have been distributed to households in displaced persons settlements	$10 per unit
Brick stove	Wood fuel is placed on a shelf in a hole in beneath of the stove, which allows air to pass underneath and mix with the wood in an extremely hot combustion chamber	More fuel efficient; it can be built quickly and cheaply with local materials		
BioLite CampStove	Small stove that generates electricity from heat that is sufficient to charge batteries	Powered by multiple fuel sources, including wood; useful source of electricity for remote areas	Used by many hurricane Sandy survivors	$130 per unit
Solar cooker	Foil-covered cardboard folded upward to direct sun's rays on a black pot, placed in the center, and covered in a plastic bag	Fuel efficient (two solar cookers can save one ton of wood per year); manufactured on-site Manufactured on-site	More than 17,000 units distributed in settlements in Darfur	$30 – the cost of two solar cookers, training, and two pot holders, which support one family
Solar lights	Portable, water-resistant, solar-powered LED lanterns with eight hours of battery life	Illumination 10-times brighter than a kerosene lamp; no flames	14 million lights sold in Africa and Asia	$7 per unit bought in bulk
Fire retardant tarpaulins	Fire retardant treated tarpaulins	Greater flame spreading time; non-treated tent burned to the ground within two minutes, whereas the FR treated tarpaulins left only burning holes of various sizes		