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Burns in the middle belt of Ghana: A systematic review

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ABSTRACT

Background: Burns are a major global public health issue affecting persons of all ages. Various studies have indicated that developing countries share a greater burden of the injury. Despite this fact, Ghana as a developing country lacks a burn repository and that makes it difficult to clearly understand the bigger picture of the injury. To this end, this study aimed to systematically review primary studies of burn occurrence in the country.

Methodology: A comprehensive literature search was undertaken using PubMed, ScienceDirect, Google Scholar, MEDLINE and EMBASE. The keywords used were "burns, epidemiology, Ghana, injury, flame burn, scald burn, electric burn, chemical burn, contact burn and explosion". Additional articles were identified by reviewing reference lists. The local journals such as the Postgraduate Medical Journal of Ghana were searched for the articles not indexed in PubMed or EMBASE. MOOSE guidelines were followed in executing this review. At the end of the selection process, seven papers remained and included in the study.

Findings: Findings from this review identified that more males than females were involved in burn injuries. Persons within the paediatric age group (particularly those under 10 years of age) were particularly susceptible to burns. This notwithstanding it was noted that there is an increasing occurrence of burns among persons in the working class group (15 years–59 years). Scald was the most common injury among the paediatric age group whilst flame burn was most common among the adult population. The home was noted to be the commonest place for burn occurrence though some disasters at fuel filling stations were recorded. The occurrence of burn was associated with various burned surface area and from the studies reviewed it was noted that higher total burned surface area (TBSA) may be linked to increasing mortality rates. Length of hospitalisation ranged from less than 10 days to 760 days. Epilepsy was reported by one study as a pre-morbid condition.

Conclusion: Burns represent a significant public health problem in Ghana and there is a need for the design of more effective intervention to reduce the occurrence of the injury. A larger scale research is imperative to investigate burns epidemiology from a national perspective.

1. Introduction

Burn injuries represent a major cause of morbidity and mortality throughout the world and its occurrence is not specific to any age group or population [1]. Burn injuries perhaps represent the widest range of any form of trauma [2]. Burn injuries may range in severity from very minor requiring no treatment to extremely severe requiring highest level of intensive treatment [2]. The burden of burn is unevenly distributed throughout the world and the majority of burns associated deaths occur in low- and middle-income countries (LMIC) [2]. Though the incidence of burn injury has been noted to be decreasing in the Western Countries, the rate of reduction has been indicated to be slower than other illnesses [3,4] and its burden remains high in African WHO regions which specify the need for public health interventions [5].

Burn injuries of varying degrees are common in Ghana as reported by various individual studies in some parts of the country. Despite this fact, the country lacks a National Burn Repository which makes it difficult to assess the actual epidemiology and outcomes of the injury [6]. The burden of burn injuries and lack of adequate epidemiological data makes it challenging for the policy makers to implement a proper strategic plan for burn prevention. High income countries are able to reduce the burn incidence and mortality through proper epidemiological research and utilizing the information for planning preventive strategies [2]. However,

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different strategic planning is required based on the unique context of a particular country. The programs which are successful in developed countries might not be translated in developing countries due to some unique differences such as demographics among others. Thus, this review aims to identify the demographics, mechanism of injury, associated risk factors, and outcome of burn injury in the middle belt of Ghana. As this is the first form of systematic review utilising various primary studies across the country, the findings will be useful for policy makers and clinicians regarding having a broader understanding of the characteristics of burns in Ghana. Also, findings can aid the design of context specific preventive strategies in the country.

2. Materials and methods

This review aimed to include all studies from January 1990 to August 2017 reporting on aetiology, incidence and outcome of burn injuries among persons in Ghana. The MOOSE guidelines were followed in this review [7]. A comprehensive literature search was undertaken using PubMed, ScienceDirect, Google Scholar, MEDLINE and EMBASE. The keywords used were "burns, epidemiology, Ghana, injury, flame burn, scald burn, electric burn, chemical burn, contact burn and explosion". Additional articles were identified by reviewing reference lists. The local journals such as the Postgraduate Medical Journal of Ghana were searched for the articles not indexed in PubMed or EMBASE. The inclusion criteria for the article were (1) articles which studied epidemiological characteristics of burn injury in Ghana, (2) only published articles or hospital based reports were included in the review, and (3) only studies reported in English Language. Articles were excluded if they fail to present the data for extraction, and also, case studies, editorials and brief commentaries were not included in this review. The data were extracted from each study into an excel spread sheet and further evaluation were done by the authors. The formal meta-analysis was not performed due to the large degree of heterogeneity between the various studies. The initial search produced 129 articles. The process of article selection for the review is summarised in Fig. 1 below:

3. Results

The electronic database search resulted in 129 articles, out of which 7 were selected for inclusion in this review (Table 1).

3.1. Demographic features and incidence of burns

Among the studies included in this review, six studies reported more males been involved in burn injuries as shown in table one above. In addition to this, six of the studies utilised data from the Komfo Anokye Teaching Hospital, which serves as a referral facility for the Northern and middle belts of Ghana. Thus, the data represents burned patients from other regions of Ghana. However, the study by Forjuoh [8] was undertaken within the confines of the Ashanti region of the Republic of Ghana. Agbenorku et al. [9] also reported on burn disasters that occurred in the middle belt of Ghana from 2007 to 2008.

Burn injuries were noted to be prevalent within the paediatric age group. For instance, from 2006 to 2009, Agbenorku et al. [10] reported that children under the age of ten (10) years formed 391 (53.5%) of the total 731 persons admitted with burns. From 2009 to 2013, Agbenorku et al. [12] observed that persons under the age of ten years (10) were 237 (48.7%) of the total 487 persons admitted with burn injuries at the Komfo Anokye Teaching Hospital (KATH). More recently, Agbenorku et al. [14] has indicated that between 2009 and 2016, children within the age limits of 0–9 years were up to 297 (43.5%) of the total 681 patients admitted with burns. Though the data presented by Agbenorku and colleagues may be limited to only admitted burned patients, the findings of Adu & Koranteng [11] provides support for the assertion that burns is more prevalent among children under 10 years. This is because they noted that from 2003 to 2012, data obtained from the Burn Intensive Care Unit (BICU), theatre and Surgical Outpatient Department of KATH indicated that persons under the age of ten (10) years formed 45% (612) of the total 1361 persons admitted or seen with burns. Despite these, Agbenorku et al. [9] noted in their study regarding burn disasters within the middle belt of Ghana that children under the age of ten years were 2 (4.3%) of the total number of 46 victims involved in the injuries who were admitted.

Aside the paediatric group, five studies reported increasing occurrence of burn injuries among persons within the working class aged 15–59 years [9,10,12–14]. Varying median and mean ages were reported by some studies: Agbenorku et al. [14] reported mean and median ages of 19.1 and 17 respectively. In similar lines, Adu and Koranteng [11] also reported median and mean ages of 11.9 years and 15.5 years respectively. Further to these, three (3) studies also reported the occurrence of burns among older persons aged 60 years and above [10,11,14].

Additionally, two studies reported on the employment status of the persons who were admitted with burn injuries. Agbenorku et al. [14] noted that 41% (279) of the burned patients were in various forms of employment whilst 12% (82) were unemployed. They further noted that majority (37%) of the burned patients were engaged in blue collar jobs as drivers, mates, cooks, farmers, electricians and fuel station attendants whilst 4% were engaged in white collar jobs. Bayuo et al. [13] also noted that artisans and farmers formed 60% (60) of the total 100 participants in their study.

3.2. Aetiology and mechanism of injury

As shown in Table 2, burn injuries in Ghana appear to have varied aetiological factors. Aside the study by Agbenorku et al. [9] which was solely due to petrol tanker explosions, all other studies reported varied causes of the injury. Hot liquids such as soups and oil were reported by five studies as the most common cause of burns in Ghana. Within the paediatric age group, scald injuries clearly dominate as noted from the studies included in this review. However among other age groups, open flames resulting from various causes such as gas explosion clearly dominate. Despite this, burns resulting from electrical and chemical sources were reported by five studies. In addition, two studies reported the occurrence of burns from unknown causes. Contact burn was also reported by one study as existing within the paediatric population [8].

3.3. Place of burn injury occurrence

Most common place of burns was identified to be the domestic setting (house) according to the studies which reported the place of burn incident. However according to the study by Agbenorku et al. [9], one episode of the burn disaster occurred at the fuel filling station whilst three explosions occurred by the road side when the petrol tankers overturned leading to discharge of their contents. Three studies also reported the occurrence of burn injuries at the work places as well.

3.4. Severity of the injury

Six studies reported varying total burned surface area (TBSA) as resulting from the injury. From 2006 to 2009, Agbenorku et al. [10] reported TBSA ranging from 10% to 100% (mean TBSA noted as

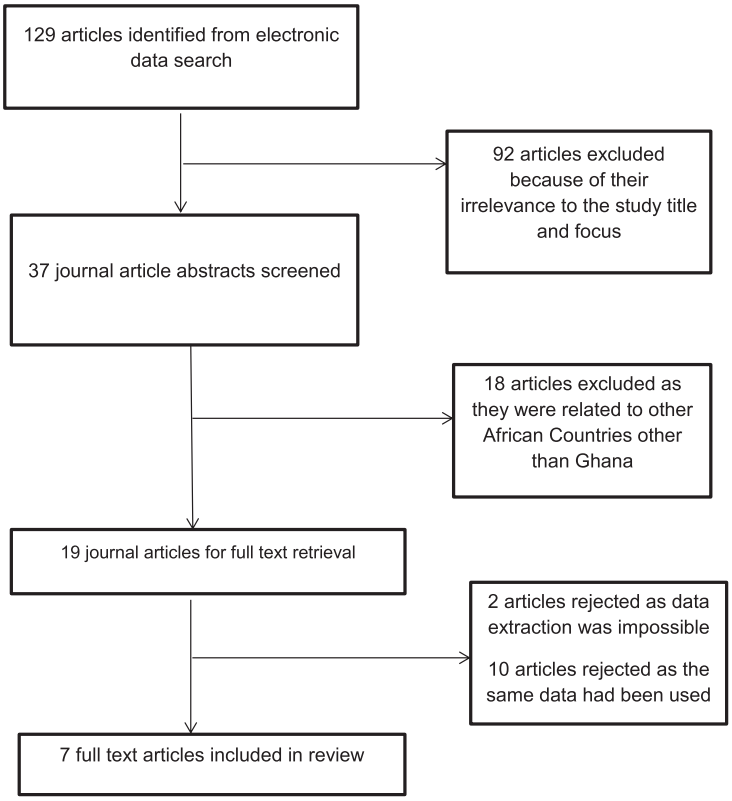

Fig. 1. Selection process of articles for review.

Table 1
Overview of studies included in review.

Author (s)	Year	Setting	Study type	Age group	Patient number	Male/female	Mortality n (%)
Forjuoh [8]	1995	Ashanti	Survey	0–5 years	650	341/309	N/A
Agbenorku et al. [9]	2010	Middle belt of Ghana	Retrospective	0–59 years	212	N/A	37 (17)
Agbenorku et al. [10]	2011	Kumasi	Retrospective	0–79 years	731	405/326	96 (13.1)
Adu & Koranteng [11]	2015	Kumasi	Retrospective	0–92 years	1361	707/654	162 (11.9)
Agbenorku et al. [12]	2016	Kumasi	Retrospective	All age groups	487	263/224	100 (20.5)
Bayuo et al. [13]	2016	Kumasi	Survey	15–55 years	100	58/42	N/A
Agbenorku et al. [14]	2017	Kumasi	Retrospective	0–89 years	681	361/320	165 (24.2)

Table 2
Mechanism of burn injuries in Ghana.

Author (s)	Age group	Patient number	Scalds	Hot object	Open flames	Unknown cause	Explosions	Electricity	Chemical
Forjuoh [8]	0–5 years	650	290	217	126	17	–	–	–
Agbenorku et al. [9]	0–59 years	212	–	–	–	–	212	–	–
Agbenorku et al. [10]	0–79 years	731	419 (57.4%)	–	279 (38.2%)	–	–	14 (1.9%)	19 (2.6%)
Adu & Koranteng [11]	0–92 years	1361	822 (60.4%)	–	276 (20.3%)	–	223 (16.4%)	12 (0.88%)	28 (2.1%)
Agbenorku et al. [12]	All age groups	487	225 (46.2%)	–	221 (45.4%)	11 (2.3%)	–	13 (2.7)	17 (3.5%)
Bayuo et al. [13]	15–55 years	100	13 (13%)	–	–	–	84 (84%)	1 (1%)	2 (2%)
Agbenorku et al. [14]	0–89 years	681	305 (44.8%)		340 (49.9%)	–	–	26 (3.8%)	10 (1.5%)

24.79%). The mean TBSA increased to 28.79% in the 2009 to 2013 epidemiological study by Agbenorku et al. [12]. In a more recent epidemiological study from 2009 to 2016, Agbenorku et al. [14] reported a mean TBSA of 30.54%. However with the study reporting on the burn disasters, it was observed the mean TBSA was indicated as 63% [9] which could mean that higher TBSA may be associated with burn disasters.

3.5. Pre-morbid condition

One study included in this review reported the occurrence of burns among persons with epilepsy [11].

3.6. Length of hospitalisation

Five studies reported length of hospitalisation for burned patients as ranging from less than ten days to 760 days. Despite this, some studies reported only length of stay in the BICU [9,10,12,14].

3.7. Mortality

Five studies reported varying rates of mortality among burned patients. These studies indicated that increasing %TBSA burn is a significant predictor of mortality. In addition, open flame burns

were also noted to be associated with higher mortality rates. The mortality rates ranged from 8.4% to 54% (recorded during the burn disasters in the middle belt of Ghana) [9,14].

4. Discussion

This systematic review summarises the epidemiological characteristics of burn injuries in the middle belt of Ghana as reported by 7 different studies. Flame burns and scalds appear to be the most common forms of burns within the Ghanaian setting. In similar lines, two systemic reviews of epidemiology of burn injuries in South Asia and East Mediterranean region have also reported flame burn being the most common cause of burn injury [15,16]. This could mean that flame burns from various causes represent a significant cause of burns in developing countries and may offer clues to developing public health interventions.

From this review, it also was observed that amongst the paediatric age group, scalds clearly dominate whilst flame burns dominate within the working age group. Similar finding was also reported by the systematic review regarding burns in Nepal authored by Tripathee and Basnet [2]. Similarly, Othman and Kendrick [15] have also noted that in the paediatric population, scalds clearly dominate accounting for 60–75% of all hospitalised burn patients, followed by flame and contact burns and children younger than two years are at high risk for scalds. They further indicate that the proportion of scalds is reported to be increasing over the years among paediatric populations. Even within the working class group, some studies from Finland, Turkey, Spain and Slovakia have reported that scald injuries were more prevalent than flame burns; up to 63% [17,18]. This finding signifies a window of opportunity in designing preventive measures to overcome the incidence of scald injuries. This is because most studies reported a higher prevalence of burns among the paediatric age group as compared to other age categories. Scald injuries usually results from hot liquids such as soups, oil and hot water. The higher prevalence of scalds among the paediatric age group has been associated with poor supervision during play, overcrowded homes and poverty. Though studies presented in this review did not report the incidence of disabilities associated with burns among children, a study from Bangladesh found that 2% of paediatric burn victims were permanently disabled, estimating a disability rate of 5.7 per 100,000 children [19]. Thus, future studies in Ghana may focus on the prevalence and typology of disabilities that burn survivors' experience.

Further to the above, the occurrence of burn disasters was reported by one study included in this review [9]. Burn disasters from petrol tanker explosions and fuel stations appear to be on the rise with one that occurred on 3rd June 2015, a most memorable one claiming hundreds of lives and damaging property. As noted in the study by Agbenorku et al. [9], such occurrences usually result in burns with increasing TBSA which favours high mortality rates. Additionally, this may also imply the need to take drastic measures to prevent future episodes as it appears to be highly preventable through measures such as not siting fuel stations close to human habitation and enforcing laws that govern the establishment of fuel stations, shopping centres and environmental cleanliness.

More worrying also is the fact that five studies reported increasing occurrence of burn injuries among persons within the working class aged 15–59 years [9,10,12–14]. This is because the working class is the labour force of the country and as such increasing prevalence of burns among them may imply reduced productivity. As observed by Agbenorku et al. [14] 37% of the burned patients were engaged in blue collar jobs as drivers, mates, cooks, farmers, electricians and fuel station attendants whilst 4% were engaged in white collar jobs. In a way, persons cited to be in blue collar jobs listed above appear to be predisposed to been victims of burns due to the nature of their jobs. Thus, there may be a need to equip such persons with basic first aid management of burns and how to react to fire disasters.

Although the house is considered to be a safe place, it is the most cited as the setting for occurrence of burn injuries especially among the paediatric age group. Tripathee and Basnet [2] have argued that the use of open fire for cooking, wearing loose fitting cloths, and poorly regulated LPG (liquefied petroleum gas) cylinders increase the risk of burn injuries in the Nepalese population. Similarly, within the Ghanaian population, the use of traditional open fire (coal pot) and LPG cylinders have been reported which predispose the household to burns. Usually, LPG cylinders are kept indoors for fear of been stolen and this makes it easy for the cylinder to leak its content within the kitchen. Additionally, most households may avoid reporting problems associated with their cylinders at the earliest possible time and instead use heavy stones or wet clothes on the regulator. These activities increase the occurrence of burns within the home setting.

Mortality of burn victims in Ghana is comparable to findings from other LMIC [20–22]. The highest mortality reported in this review is 54% with the lowest been 8.4%. The high mortality rate reported by Agbenorku et al. [9] was associated with a mean TBSA of 63% which was recorded from a burn disaster. This augments the fact that increasing TBSA favours increasing risk for mortality [1]. The mortality rate in developed country is very low compared to LMIC. In this regard, over 50% of all patients with burns involving 80% of their total body surface area (TBSA) have been noted to survive, and the survival rate may be higher in adolescents and young adults [23]. This may however be difficult for Ghana due to poor first aid management, time lost between the injury and initiation of proper treatment, poor economic status, inadequate resources at the clinical setting among others. Additionally, burns training programmes appear to be limited especially for nurses and as such interested persons may have to seek for such opportunities outside the country. Though in recent times, THET in collaboration with the National Reconstructive Surgery and Burns Centre, RESURGE Africa and Canniesburn Plastic Surgery Unit organised a postgraduate diploma programme in burns and plastic surgery for nurses, there is more to be done to have dedicated burn care teams across the country to offer specialist care.

The occurrence of various pre-morbid conditions has been reported among burned patients. In this study, epilepsy was reported by one study. This is of interest to burn care practitioners as a person identified to be experiencing an epileptic attack will not be rescued by onlookers as it is believed among some persons in Ghana that the disease is contagious and can be transmitted through body fluids. Thus, even when the person is in contact with fire, rescue by onlookers may be an issue and prolonged contact with the cause of burns may mean an increased depth of the injury. This implies that there is a need for mass education to debunk such beliefs and makes the society a safe place for these persons.

In conclusion, burns represent a significant public health problem in Ghana considering our limited resources. Although Ghana shares a huge burden of burn injury, the studies concerning burn epidemiology and management are limited within our setting. To the authors' best knowledge, this is the first systematic review that provides an overview of the burns within the Ghanaian setting. As most of the studies included in this review are retrospective in nature, there is a need for more studies across the country. This may mean the need to provide funding for such worthwhile activity. Additionally, there is a need for closer collaboration between burn care practitioners and public health experts in the design and implementation of preventive measures to reduce the burden of the injury. Health training institutions also need to consider devel-

oping burn care modules to train personnels locally in the practice of burns management. Though the study presents an overview of burns in the middle belt of Ghana, it still appears to have some limitations. Firstly, although the authors undertook thorough literature search in various databases and also complete our search by reviewing related and cross-referencing literature, existence of missing studies can never be excluded. Additionally, the majority of data were obtained from studies undertaken within hospitals, limiting their generalization on a population level.

Conflict of interest

None declared.

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