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Modernized standards in burns management: A comparative study in Komfo Anokye Teaching Hospital, Kumasi, Ghana

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ABSTRACT

Background: Management of burns patients before May 2009 was very difficult at the Komfo Anokye Teaching Hospital (KATH).
Aim: To compile burns patients' information in the *new Burns Intensive Care Unit* (*BICU*), analyze it and draw comparisons to information from the *old BICU* at KATH.
Methods: This retrospective study involves data from May 2007 to April 2009 (Group 1 – *old BICU*) and May 2009 to April 2011 (Group 2 – *new BICU*). The parameters of burn patients recorded included: record of admission, gender, age, aetiology of injury, Total Burns Surface Area (TBSA), the patients' treatment regime and record of discharge/death. This information was analyzed with SPSS version 18.0.
Results: The total number of patients in the study was 511; Group 1 constituted 47.36% ($n = 242$) patients; males ($n = 307$, 61%) outnumbering females ($n = 204$, 39%). The overall mean, median and interquartile range (IQR) ages of the patients were 12.4 ± 2; 9.5 and 18.0 years respectively. The main aetiology of burns in Group 1 was flame burns ($n = 115$, 47.5%) and for Group 2 was scald ($n = 151$, 56.1%). The median TBSA recorded for Groups 1 and 2 were 32% and 41% respectively. A mortality rate of 19.1% ($n = 46$) and 12.7% ($n = 34$) were recorded for Groups 1 and 2 respectively which was statistically significant ($p < 0.05$). We found no differences for age and TBSA ($P = 0.7168$ and $P = 0.8020$ respectively). A Chi Square analysis for gender and aetiology of burn revealed no significant difference between Groups 1 and 2. A risk factor analysis for mortality within the Groups (using multiple regression analysis) identified only aetiology of burn in Group 1 to be a factor ($P = 0.044$).
Conclusion: This comparative study reveals that a significant difference in mortality was recorded for both groups. The mortality difference does not appear to be due to socio-demographic features. This study may demonstrate that modernized and advanced equipment with the adequate personnel play an essential role in burn management in low income countries such as Ghana.

1. Introduction

There have been recurrent burn disasters around and within the Kumasi metropolis and environs which have claimed several lives [1]. Burns victims were either transported immediately to the Komfo Anokye Teaching Hospital (KATH) in Kumasi or referred to KATH by district hospitals. Burns are a major cause of death and disability and are associated with significant national healthcare resource utilization. Burns

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patients often undergo long periods of rehabilitation, multiple skin grafts, and extensive physical therapy. Not only can burn-related injuries leave patients with lifelong physical disabilities but burns can also result in severe psychological and emotional distress due to scarring, which often also result in significant burdens for the patients' families and caregivers. Burns are associated with relatively high mortality and morbidity worldwide, especially in the developing countries [2,3]. There are approximately 1500 burns cases in Ghana annually and a sizeable fraction of these burns occur in large scale disasters caused by petrol-related fires [1,4–8]. Burns are among the top 10 external causes of death in South Africa, and in 2004 burns violence was the leading cause of unnatural death in children aged 1–4 years [5].

KATH is the second-largest hospital in the country and the only tertiary health institution in the middle belt of the country. It is the main referral hospital for the Ashanti, Brong Ahafo, Northern, Upper East, and Upper West Regions. It was converted into a teaching hospital in 1975, affiliated to the School of Medical Sciences of the Kwame Nkrumah University of Science and Technology, Kumasi. The hospital is also accredited for postgraduate training in various surgical and medical disciplines. The hospital currently has 1000 beds; up from the initial 500 when first built. Annually, the hospital attends to about 479,050 patients made up of both out- and in-patients (Biostatistics Unit, 2010). The KATH Burns Intensive Care Unit (BICU) was opened in 1st February, 2001 through the collaborative efforts of ReSurge Africa and the Plastic Surgery Team in KATH spearheaded by Dr. Pius Agbenorku [9]. The management of burns patients in KATH Reconstructive Plastic Surgery and Burns Unit before May 2009 was a problem due to the status of the casualty unit in terms of equipment and personnel for the specialist surgeons and the other health personnel. Since its establishment the unit has been in the forefront in management of burns victims in the central belt of Ghana [1]. Most of the equipment used for the various procedures were either broken or absent in the unit, resulting in increased toll on burned patients. Death of patients may even occur with Total Burns Surface Area (TBSA) of 10% in the unit. Notwithstanding all this, personnel of the unit did their best to give hope and life to more burns patients [7].

The establishment of a new Accident and Emergency (A&E) Centre in KATH by the Government of Ghana, which started operations in 2009 – which also houses Reconstructive Plastic Surgery & Burns Unit – was welcomed by both medical practitioners and the general public. The new BICU, as an ultramodern centre has been equipped with all sophiscated equipment for the management of burns and other plastic surgical patients at all levels. The new A&E Centre in KATH has helped to manage many of these cases with ease, which of course before its establishment could be fatal. The KATH A&E Centre also has a helipad which permits easy transport of patients to the centre.

Burns management in developing countries encounters huge problems at any stage [8]. Inadequate access to burn care facilities and a poorly-equipped health care system hinder optimal treatment [9]. This retrospective study aimed to compile burns patients information in the *new BICU*, analyze it and draw comparison with information from the *old BICU* at KATH.

2. Materials and methods

2.1. Data collection and analysis

This retrospective study involved data from May 2007 to April 2009 (*Group 1 – old BICU*) and May 2009–April 2011 (*Group 2 – New BICU*). The parameters of all burn patients admitted to the BICU were entered into a computer database. These included: record of admission, gender, age, causes of injury, TBSA burned, and the patients' treatment regime, i.e. wound dressings, early tangential burned wound excision/delayed excision with split-thickness skin grafting, antibiotic regime, and record of discharge/death. The patients also did various laboratory tests (haemoglobin levels, electrolytes, kidney and liver function tests, wound swabs for culture and sensitivity tests). This information was analyzed with SPSS version 18.0 (SPSS, Inc., Chicago, IL, USA).

Patients/relatives of patients gave their consent for the study by signing or thumb printing the study consent form. Ethical approval for this study was obtained from the KNUST School of Medical Sciences/KATH Committee on Human Research, Publications and Ethics.

2.2. Stages injured patients went through before been admitted

2.2.1. Group 1

Patients in this Group when referred (spent average of 3 days before being referred) when their health is deteriorated or transported to KATH after sustaining burns were directed to the KATH polyclinic which housed the Casualty Unit. The Unit had two rooms (each having ordinary beds), one each for male and female patients, which was used for emergency treatment/resuscitation for all categories of patients. The unit had no resuscitation equipment nor ventilated beds. Upon arrival in the unit, the patient was first seen by general nurses on duty, who in turn reported the case to the BICU. The BICU team, headed by a plastic surgeon/resident was to walk to the casualty unit (which was a separate building from the casualty unit) to attend to the patient which could take 45 min. After the patient had been stabilized he/she could be discharged home or transported by an ambulance to the appropriate ward or the specialized unit – BICU in the old KATH block. In terms of cost of treatment, most patients with National Health Insurance Scheme (NHIS) had the cost paid by the scheme, however, those without had to pay for the cost either by themselves or by relatives (Table 1).

2.2.2. Group 2

In this group, patients were referred (average of 4.5 days) when their condition is deteriorated or transported to KATH A&E Centre. The centre is made up of three floors, with the ground and first floors purposely for medical/surgical cases (having a total of 100 ventilated bed capacities); while, the last floor is used for administrative purposes on top of which is situated a

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Table 1 – A Comparative model for Group 1 and 2 in the study.

	Group 1	Group 2
Accessibility to casualty/A&E centre	Accessible	Accessible
Triage	No triage system available	Triage by specialized staff available
Emergency medical staff	Not available	Available, actively manage patients including IV lines, intubation
Plastic surgery specialist call	Often and not available. Sometimes done by general surgical team on duty, OR patient is directly seen by plastic surgery team on duty by visiting the casualty	Quickly called by emergency medical staff while still attending to the patient
Time to see patient by Plastic Surgery team on duty	45–60 min	5–7 min
Transfer to BICU	Quite some distance away, transport by KATH ambulance, which may not be available all the time, generally takes 30 min	BICU is on the 1st floor of the same building; transport by an elevator (lift), takes about 5 min
Treatment protocol	Same in anaesthetist services often not available	Both BICU's anaesthetist services always available
Operating theatre	Quite some distance away in another building, patient transport takes about 20 min	On the same floor as the BICU, adjacent, takes 1 minute
Gadgets	No specialized gadgets	Ultra modern specialized gadgets
BICU Beds	Nothing specialized (6 beds) in one open unisex ward with one common toilet facility	Specialized bed each in 6 well air conditioned rooms with ward toilet facilities.

helipad. A patient upon entering the ground floor of the centre was immediately attended to by triage nurses, who upon their expertise decide to send the patient to any of the units: First Aid Unit – *Yellow Section*; Minor Treatment Unit – *Orange Section* and Major Treatment Unit – *Red Section*). *These* units are well equipment with tools to attend to any A&E case. From these units the plastic team-on-duty is called by the emergency physician team-on-duty attending to the patient. The surgeon or his resident/registrar gets to the patient within the shortest possible time (approximately 5 min) and makes the decision: admission to Orange or Red Section or to the Burns Ward (old BICU) in the old KATH block or admission to the new BICU on the first floor of the A&E Centre. Cost incurred by burn patients was mostly covered by the National Health Insurance Scheme. Patients with no insurance paid for the cost- an average amount of $1000 (Table 1).

2.3. *Staffing, training and work commitment*

The Reconstructive Plastic Surgery and Burns Unit started in 1993 with only one consultant plastic surgeon, a few general nurses and auxiliary nursing staff but grew steadily with staffing [9]. More general nurses were added by the hospital administration, of whom six were sponsored by a Scottish NGO – the International Reconstructive Plastic Surgery (Ghana) Project (now called ReSurge Africa) – to receive training in plastic surgery centres in Dundee and Glasgow, Scotland before the establishment of the old BICU. Also, during this period, surgical residents were obliged to rotate in the unit. Before and after May 2009, several training workshops and seminars were organized by the consultant-in-charge of the unit, who had himself attended several such international meetings locally and abroad [9]. The burns management team was also joined by a clinical pharmacy team, who together with the physiotherapists and nutritionists all conducted combined weekly grand ward rounds [9]. The team was joined by two more consultants.

2.4. *KATH accident and emergency centre protocol for burns management*

The Emergency Physicians receive the burns patients first after having been assessed by the triage nurses; they follow a protocol provided by the plastic surgery team (Pain management procedures and antibiotics application are similar to that of the old BICU):

2.4.1. *Summary of protocol*

- Apply the principle of ABC as in trauma management
- Ensure the patient is conscious
- Ensure the airway is patent and the patient is breathing
- Check the pulse and BP
- Set up IV line with Ringers Lactate running
- Quickly and systematically identify life threatening conditions
- Keep the patient warm; use blankets if necessary
- Intubate/arrange for intubation of patient if required
- Administer 100% humidified oxygen, if necessary
- Insert Foley's urinary catheter. Achieve a urine output of 0.5 ml/kg/h in adults and 1.2 ml/kg/h in children
- Take a quick history, including medications, allergies and mechanism of injury; complete clerking of patient
- Give analgesics: IV Morphine 0.1 mg/kg or oral syrup Morphine sulphate 10 mg/kg body weight; diclofenac injection 1 mg/kg and/or diclofenac suppositories for less severe cases, while in very severe cases IV pethidine 1 mg/kg body weight every 6 h; paracetamol suppository/syrup for children
- Estimate percentage of burned body surface area involved. Using Wallace's Rule of the Nines for initial assessment; however Lund and Browder Charts are preferable
- Recommended fluid therapy formula:
  Parkland Formula
  4 ml/kg for each percent of TBSA (4 × mass (kg) × BSA (%) mls/24 h)

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Give 50% in the first 8 h of the injury and the rest in the next 16 h
- Administer tetanus prophylaxis as dictated by the patient's immunization status
- Inspect the wounds.
- Criteria for admission:
  - Adults with TBSA of 15% or more
  - Children with TBSA of 10% or more
  - Burns of special areas – face, perineum, hand and joints
  - People at extremes of life – young children and the aged
  - Burns with other trauma or any other disease
  - Infected burn wounds
- Detain the patient at the A&E Unit
- Inform plastic surgery team-on-duty: resident/house officer/consultant
- Criteria for discharge:
  - After wound healing progress is satisfactory to the plastic surgery team.
  - When BICU personnel consider the patient is ready for return transfer, following comprehensive multi-disciplinary discharge planning.
  - After acute surgical treatment has been completed.
  - After very early reconstructive surgery such as severe neck contracture release has been completed.
  - After complex splints such as mouth splints have been made and the problems addressed.
  - After physical therapists declare patient not to need daily intervention by their team – thus the patient is fit to undergo physical treatment on out-patient-department (OPD) basis for about 2–3 times per week.

2.5. *Surgery and wound dressing for both groups*

2.5.1. *Surgery*

All patients were assessed for anaesthesia immediately after they were admitted. Those who were fit for early tangential excision and split-thickness skin grafting of the burn were operated on either the same or the following day, i.e. within 48 h. ''Delayed'' surgery was normally performed within 5–7 days (in a few cases within two weeks). However, most had no surgery but were managed with wound dressings.

2.5.2. *Wound dressing*

Wound dressings were applied with normal saline and covered with Vaseline gauze dressing; foam was then applied and crepe-bandaged. Patients with facial burns were treated with open wound dressings and Dermazine cream; those who reacted to this cream were therefore suspended, their wounds eventually healing after daily dressings with normal saline and the application of Vaseline gauze. These procedures were performed by Plastic Surgery and General Nurses (who had adequate training).

2.6. *Nutrition and physiotherapy*

The nutritional status of the patients was also evaluated by the nutritionists on the management team; food supplements were given where necessary. Splinting and the positioning of body parts were checked by the ward nurses and relatives, with advice from the physiotherapists on the team, who also carried out daily physical therapy interventions in order to prevent complications such as muscle atrophy and joint contractures.

2.7. *Laboratory investigations*

Electrolytes were followed regularly (daily basis) and any deficiencies corrected accordingly. Kidney function was also checked regularly, mainly with regard to urine output (urea, creatinine, and creatinine clearance). Haemoglobin was checked regularly and deficiencies were corrected with fresh blood and/or fresh frozen plasma. On day 5 after admission, wound swabs for culture and sensitivity were taken and the antibiotic regime changed or continued accordingly.

2.8. *Other factors*

Patients were monitored for other signs and symptoms, e.g. malaria, hypostatic pneumonia, and urinary tract infections, and treated accordingly.

In summary, patients for both the old and new BICU had the same care. The differences in their management were the introduction of the new BICU's equipment, units and staffs training including the triage nurses and emergency physicians.

3. Results

3.1. *Demographic characteristics of patients*

The total number of patients in the study was 511, with Group 1 constituting 47.36% ($n = 242$) patients and Group 2 having 52.64% ($n = 269$) patients. Few [19.8% (48) and 27.5% (74) for Group 1 and 2 respectively] of the patients had surgery for burn wound excision and/or skin grafting. In all, males ($n = 307$, 61%) outnumbered females ($n = 204$, 39%) in the ratio of 3:2. The overall mean and median age of the patients was 12.4 ± 2, and 9.5 years respectively, with Interquartile Range (IQR) age of 18 years (i.e. IQR = 6–24) (Fig. 1).

3.2. *Aetiology of burn injury*

The most prevalent cause of burn for Group 1 was flame ($n = 115$, 47.5%) followed in decreasing order of magnitude by scalds ($n = 97$, 39.7%), chemical ($n = 19$, 8.0%), and electricity ($n = 11$, 4.8%). For Group 2 scalds ($n = 151$, 56.1%) was the commonest cause of burn, with flame, chemical and electrical following in a descending order (Fig. 2). Also, Inhalation injuries were relatively few in both Group 1 and 2 (11 and 19 patients respectively).

3.3. *TBSA/degree of burns*

The median TBSA recorded for Groups 1 and 2 were 32% and 41% respectively (overall median TBSA 40%). Second degree burns accounted for most of the burn cases in both periods of study (Table 2).

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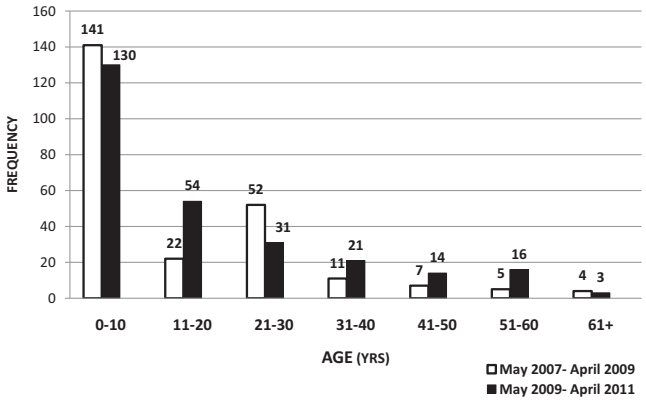

Fig. 1 – Age distribution of burns patients in the study.

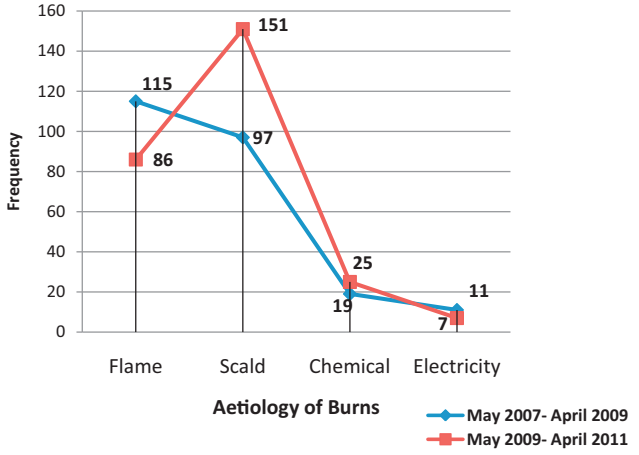

Fig. 2 – Aetiology of the burn.

3.4. *Mortality*

During the two periods of study, death cases were recorded in almost all the distribution of the various TBSA. A mortality rate of 19.1% ($n = 46$) and 12.7% ($n = 34$) were recorded for Groups 1 and 2 respectively (Table 3).

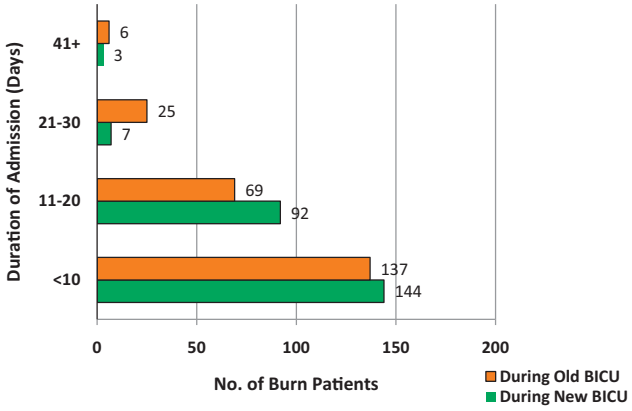

Fig. 3 – Duration of hospital admission of patients in the two groups of study.

3.5. *Hospitalization of patients*

The study showed that the majority of the patients ($n = 281$, 55%) for both study Groups remained in the BICU for less than 10 days after admission with very few ($n = 9$, 1.8%) remaining for 41+ days (Fig. 3).

3.6. *Analysis of data*

3.6.1. *Using Student's t-test and chi-square*

Student's *t*-test was used to determine differences between Group 1 and 2 in terms of age and TBSA; Pearson's chi-square test was used in the significant difference determination of gender, aetiology, and mortality between groups. A probability value (*P*-value) of less than 0.05 was considered to be statistically significant.

Analysis reveals significant difference for mortality ($P = 0.036$) only, while, Chi-square showed no significant difference in none of the categories tested (Table 4).

Table 2 – Total body surface area (TBSA) and burns degree.

TBSA (%)	May 2007–April 2009 (Group 1)	May 2009–April 2011 (Group 2)	No. of patients with degree of burn	
			Second	Third
1–10	21	12	15	18
11–20	16	7	17	6
21–30	76	28	87	17
31–40	14	81	74	21
41–50	57	22	43	36
51–60	21	64	73	12
61–70	19	36	30	25
71–80	11	6	12	5
81+	7	13	14	8
Total	242	269	365	148

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Table 3 – Mortality among burns patients with their associated TBSA.

TBSA (%)	May 2007–April 2009 (Group 1)			May 2009–April 2011 (Group 2)		
	Burn	Death cases (%)	Mortality rate (%)	Burn	Death cases (%)	Mortality rate (%)
1–10	21	0	0	12	1 (8.3)	8
11–20	16	1	6	7	0 (0.0)	0
21–30	76	0	0	28	2 (7.1)	7
31–40	14	5	35	81	0 (0.0)	0
41–50	57	8	14	22	2 (9.1)	9
51–60	21	7	26	64	4 (6.3)	6
61–70	19	11	58	36	9 (25.0)	25
71–80	11	7	64	6	3 (50.0)	50
81+	7	7	100	13	13(100.0)	100
Total(N)	242	46	19.10	269	34	12.70

3.6.2. *Using multiple regression*

A regression analysis was performed to determine if there is any risk factor(s) (age, gender, aetiology of burns, TBSA, LOS) associated with mortality in any of the Groups. A probability value (*P*-value) of less than 0.05 was considered to be statistically significant at 95% confidence interval. It was shown that, aetiology ($P = 0.044$) of a risk factor for mortality in Group 1, while, no risk factor was identified in Group 2 (Table 5).

4. Discussion

In the old BICU of KATH, there has been continuing efforts to standardize the quality of care. This would mean that clinical practice guidelines be established for the different problems encountered by the surgeon and other health personnel. Management of burns patients to the optimum satisfaction was a problem for personnel in the old BICU. A glimpse of hope appeared when the new BICU was established. In this study, the aim was to compile burns patients information in the new BICU, analyze it and draw comparison with information from the old BICU at KATH. Apart from the difference in infrastructure, equipments, beds and time spent before been attended to by the plastic surgery team-on-duty between the Casualty Unit and A&E Centre which housed the old and new BICU respectively, comparison was the emphasis on mortality.

Table 4 – Using Student's *t*-test and chi-square to compare the study groups.

Parameter	*P-Value*
Student's *t*-test	
Age	0.7168
TBSA	0.8020
Mortality	0.0321*
LOS	1.8010
Chi-square test	
Gender	1.451
Aetiology	0.150

* Significant value ($P < 0.05$).

Table 5 – Risk factor(s) associated with mortality (Regression Analysis).

Model	Standardized coefficients	*P*-value	
	Beta	Group 1	Group 2
Age	0.287	0.202	0.605
Gender	0.436	0.194	0.441
Aetiology	−0.864	0.044*	0.141
TBSA	−0.139	1.123	0.321
LOS	0.614	0.210	0.075

* Significant value ($P < 0.05$).

This study recorded a mortality of 19.1% for Group1 which decreased to 12.7% in Group 2, the chi-square analysis also showed a statistically significant difference ($P = 0.0321$) for the mortality recorded. Though other studies [10,11] have reported decreases in burns mortality, these have not been as marked as that in this study. The variation in the mortality between the Groups has nothing to do with any socio-demographic feature of the study, nor TBSA. Thus the same category of patients (in terms of age, gender, TBSA, LOS) were managed in both Groups, hence improved mortality in the study would be attributed to the improvement in the treatment of burns patients with new equipment with prompt attendance to patients supported in the new BICU and increased number of plastic surgery medical personnel. Early surgical intervention and rapid resuscitation including intubation of inhalational burns by the emergency physicians also contributed to reducing the mortality and the number of days spent by patients in the hospital. The differences in the set-up of both BICUs also added to the change in mortality in both Groups. As described in the methodology section, resuscitation and decision making on patients is faster and effective in Group 2. This study is an indication that if BICUs in Ghana and other low income countries are well equipped with modern devices, couple with well trained burns personnel, it will go a long way to minimize burns mortality in these countries.

Also importantly, an additional within Groups analysis considering risk factors of mortality at the BICUs, was performed to help identify these unknown factors. In Group 1, aetiology of burns ($P = 0.044$) was identified as a risk factor of mortality. Although other burn studies in Angola, Cote D'Ivoire, Egypt and Nigeria had age, gender and aetiology of burn as the main risk factors [5,12,13] none was determined in Group 2, which still buttresses the fact that new equipment and well and numerous trained personnel play a major role in

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the alleviation of burn mortality in low income countries. This indicated that burn caused by flame was the common factor, with a magnitude of 47.5% for Group 1 patients. Flame burns included: gas explosions, petroleum and burning wood/bush/clothing. Similar results as that of Group 1 had been reported from studies in countries such as Egypt [14,15], India [16], Jordan [17] and Nigeria [10]. Aetiological factors are highly specific to each country, largely depending on the standard of living and lifestyle. However, other studies identified scald as the most frequent aetiological factor of burn in reports from Japan [18] and Nigeria [19], thus representing some 40%–78% of cases. The regression analysis -though not much important in this study- was conducted to give a headlight to other African and local study that consider aetiology as the central aim. Since this study had a broader data for two different groups it was wise to add the regression analysis for literature purposes.

5. Conclusion

The comparative study reveals a much similar trend in the demographic features; however a difference in mortality was recorded for both Groups. The difference may had been associated with new equipment coupled with numerous and well trained personnel. The only risk factor identified in Group 1 was aetiology of burns; none was found for Group 2. For appropriate burns management, this study demonstrates that modernized and advanced equipment with the adequate personnel probably played an essential role in developing countries such as Ghana.

Conflict of interest statement

None declared.

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