



# Epidemiology and outcomes of burn injury among older adults in a Ghanaian tertiary hospital



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## ABSTRACT

**Background:** Though older adults are affected by burn injuries, there has been limited exploration of their characteristics in Ghana.

**Objective:** To assess the epidemiology and outcomes of burn injury among older adults.

**Methodology:** A retrospective approach was utilised. Admission and Discharge Books were used to retrieve records of burn patients aged 60 years and above from 2008 to 2015. SPSS version 21 was used to perform descriptive and multivariate statistical analysis.

**Results:** Out of the 618 admissions, patients aged 60 years and above were 31 (5.0%). Burn injuries were commonest among the 60–69 year group (45.2%). A greater proportion of older adults in the study were farmers (38.7%). The year 2011 recorded the highest admission and death but mortality rates were equally high in all years represented in this study except in 2010. The mean age was 69.74 years. Though more females (67.7%) than males (32.3%) were involved in burn injuries, mortality was marginally higher in males than females. Thermal burns resulting from gas explosion (51.60%) and bush fires (22.60%) were major aetiological factors. Logistic regression analysis indicated that increasing age ( $p = .002$ ) and increasing TBSA ( $p < .001$ ) were associated with higher mortality rates.

**Conclusion:** As the older adult population is expected to increase, there is the need to execute appropriate interventions such as safe farming practises and proper household utilisation of Liquefied Petroleum Gas (LPG) products. Further studies are needed in understanding gender variations in burn survival among older adults.

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## 1. Introduction

Burn injuries are injuries that result in considerable morbidity and mortality within a given population [1]. Despite increased education on burn prevention, burn injuries continue to present a significant social and fiscal burden [2]. Burn injuries are not specific to any given population or location. They affect every age group, ethnicity and occupation. Aside children, elderly persons (defined as individuals aged 60 years and above [3]) have also been cited as individuals with a high risk of being involved in burn injury [4–6]. The incidence of burn injury among the older adult population has been attributed to decreased physical strength,

impaired protective mechanism, poor vision, existence of multiple co-morbidities and decreased reaction time [7]. Some incidence of burns in the elderly has been attributed to abuse and neglect [8]. Though older adults are affected by burn injury, burn related studies in Ghana have focused mostly on the paediatric population with limited exploration of characteristics of older burn patients. For instance, Adu and Koranteng [9] studied a ten year trend of burn injury in Kumasi but the discussion of their study focused heavily on patients aged 0 to ten (10) years. A similar trend was noted in the 2006–2009 epidemiological study by Agbenorku et al., [10] as discussion focused on the paediatric population. Also, Bayuo, Agbenorku and Amankwa [11] studied issues associated with burn injury survival among one hundred (100) survivors. However, the ages of the participants were within the ranges of 15–55 years.

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Thus, though older adults are also affected by burn injuries, no study currently exist that has explored their characteristics, epidemiology and outcomes of management. This fact necessitates the need to comprehend the trend of burn injury and management among older adults so as to plan appropriate health education interventions for this cohort of patients.

## 2. Materials and methods

### 2.1. Setting

This retrospective study was conducted using data available at the Burns Intensive Care Unit and Ward D2C of the Komfo Anokye Teaching Hospital (KATH). KATH is the second largest tertiary hospital in Ghana and the main referral point for the middle belt of Ghana serving the Ashanti, Brong Ahafo, the Northern, Upper West and Upper East regions of the country. The hospital was established in 1954 and is affiliated to the School of Medical Sciences of the Kwame Nkrumah University of Science and Technology (KNUST). The hospital currently has 1000 beds, with an annual hospital attendance of about 679,050 patients made up of both out- and in-patients. The two burn units are six bed capacity each dedicated to varying degrees of burn injuries. The Burns Intensive Care Unit is dedicated to severe burns as well as burns involving special parts of the body, inhalational injury and burns with comorbidities [12].

### 2.2. Ethical clearance

Ethical clearance for this study was obtained from KNUST School of Medical Sciences/KATH Committee on Human Research, Publications and Ethics, Kumasi.

### 2.3. Data collection

A retrospective approach was utilised. Information regarding burn older patients (individuals aged 60 years and above) who were admitted to the burn units from January 2008 to December 2015 were retrieved from the wards' Admission and Discharge Books. Also their folders were retrieved to confirm data obtained from the Admission and Discharge Books. Folders with missing data such as age were excluded from the study. Also, absconded patients were excluded from the study as outcome of their management could not be determined. The Admission and Discharge Books were double checked to ensure that all patients transferred to Ward D2C from the Burns Intensive Care Unit were captured only once onto the study data. To this end, data were obtained from the documents of 31 patients. All retrieved folders were studied closely from period of admission till death or discharge. Data obtained include age, gender, history of burn injury, aetiology, occupation, date of admission, date of discharge/death and outcome of management. Also, the burn wound charts of the patients were obtained from their folders to confirm per cent Total Body Surface Area (% TBSA).

### 2.4. Data analysis

Data obtained from the records were entered into Statistical Package for Social Science (SPSS) version 21 [13]. Descriptive statistics in the form of tables and cross tabulations were generated to understand the characteristics of the study subjects ( $n = 31$ ). Multiple linear regression was also carried out to assess predictors of outcomes of burn care among older persons with a probability value ( $P$ -value) of less than 0.05 considered to be statistically significant at 95% confidence interval.

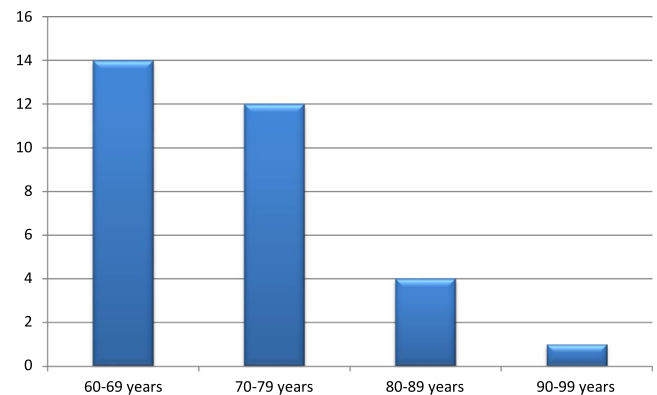
## 3. Results

Out of the 618 admissions, patients aged 60 years and above were 31 (5%) as shown in Table 1. Out of the total number of older burn cases recorded ( $n = 31$ ), the year 2011 had the greatest number of admissions of older adults ( $n = 7$ ) out of a total population of 105 burned patients for that year and the least admission was noted in 2009 ( $n = 2$ ). However, the year 2010 did not record any admission of an older burned patient.

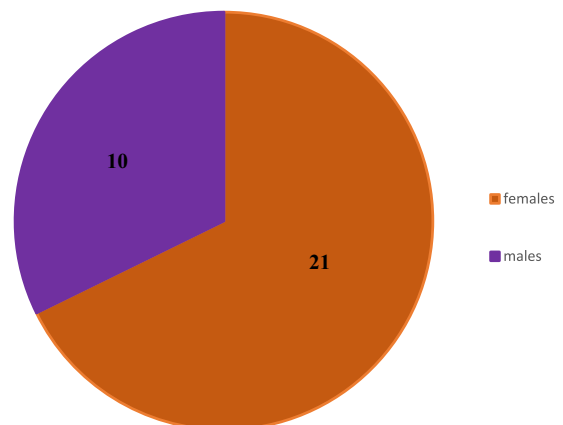
In addition, all the years presented in Table 1 above indicate that the mortality rate was higher than the discharge rate. Overall, a greater proportion of older adults died (67.7%) as compared to those who were discharged (32.3%).

**Table 1**  
Eight year trend analysis of burns outcomes in older adults.

Year * Outcome Cross Tabulation				
Count		Outcome		Total
		Died	Discharged	
Year	2008	1	2	3
	2009	1	1	2
	2010	0	0	0
	2011	5	2	7
	2012	6	0	6
	2013	2	1	3
	2014	3	0	3
	2015	3	4	7
Total		21	10	31



**Fig. 1.** Age distribution of patients.



**Fig. 2.** Gender distribution of patients.

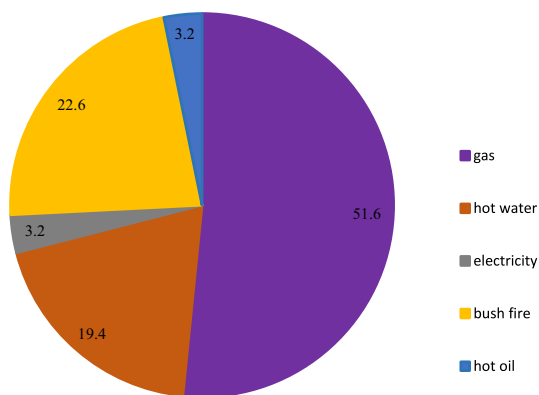


Fig. 3. Aetiology of burns (percentages).

### 3.1. Socio-demographic features and clinical details of admitted older burned clients

As shown in Fig. 1, a greater number of older adults were within the range of 60–69 years (45.2%) and the least in the range of 90–99 years (3.2%). The mean age was noted as 69.74 years (S.D = 9.140).

In terms of gender, 21 (67.7%) were females and 10 (32.3%) were males (Fig. 2). In terms of occupation, majority were farmers (38.7%). Further to this, most of the older burned persons [21 (67.7%)] were from various semi-urban areas in Ghana.

As indicated in Fig. 3, gas explosion was a major cause of burns (51.60%). Also, bush fires caused substantial number of burn injuries among older adults (22.60%).

Burns that affected older adults in the study were mostly within the range of 1–20% TBSA (32.3%) and 21–40% TBSA as shown in Fig. 4. In addition, a substantial number were affected by burns

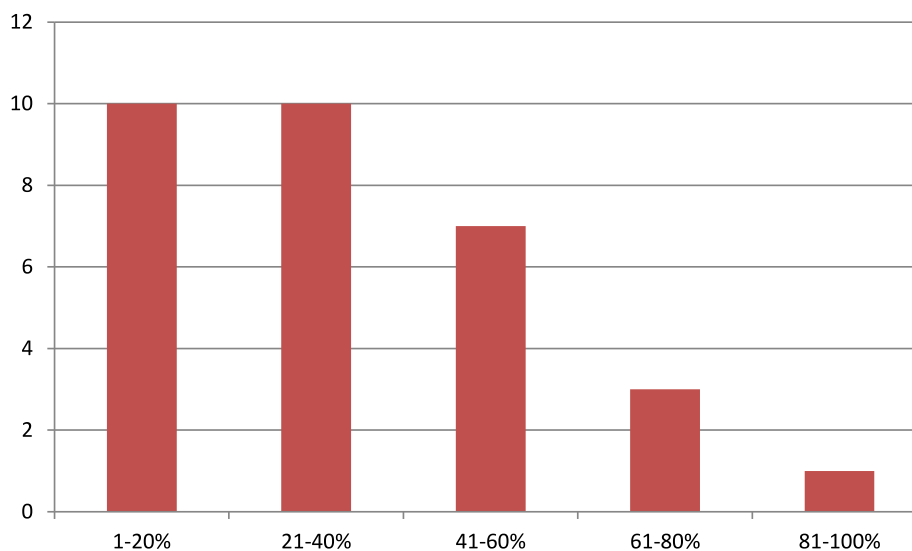


Fig. 4. % Total body surface area (%TBSA).

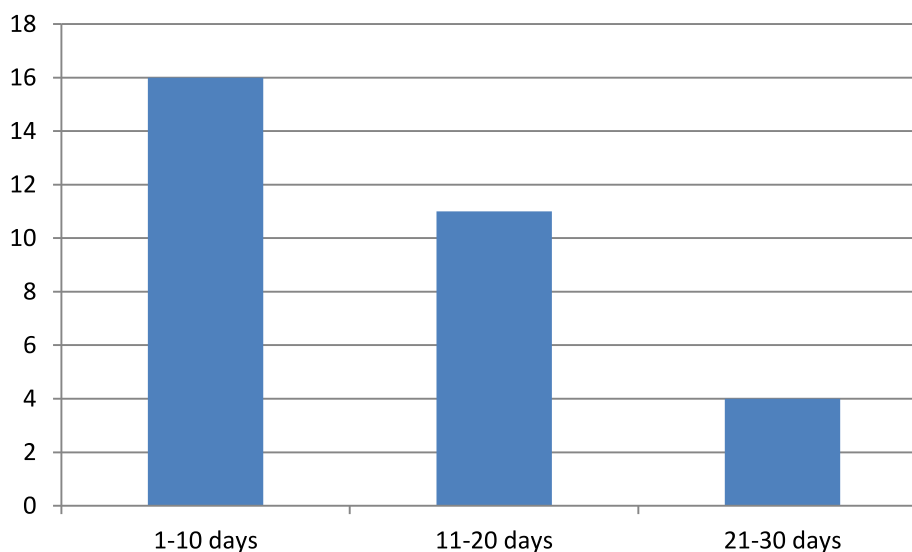


Fig. 5. Days on admission.

within the range of 41–60% TBSA (22.6%). In addition, three older persons sustained inhalational injury and this was associated with thermal burns that occurred in enclosed environment.

As shown in Fig. 5, 51.6% of patients admitted spent 1–10 days on admission before been discharged or dying. Mean number of days on admission was noted as 12.19. Median days on admission were also noted as 10. In terms of outcome, more than half of older adults with burn injury died (67.7%). The causes of death as indicated in the folders were organ failure, septicemia and inhalational injury.

Table 2 specifies cross-tabulation among some variables. In terms of age range and outcome, with the exception of those in the 80–89 year range, more than half of the patients died. In terms of gender and outcomes of management, mortality was high among the male population and a higher discharge rate was noted among females. Considering gender and aetiology, more females

were involved in thermal and scald burns. Also, one male was involved in electrical burns but this was not noted among the female group. Further to this, hot oil burns was noted among the female population and was absent among the males. In terms of aetiology and outcomes, older persons who were involved in flame injuries appeared to experience greater mortality rates as compared to persons who sustained the injury from other sources. Despite this result, the link between these variables is beyond the scope of this study. Also, it is worth noting that there may be other contributing factors such as septicemia or worsening of pre-morbid conditions which may affect outcome.

Patients with scalds appeared to have greater discharge rates as compared to persons with flame burns. In addition, as TBSA increased, mortality increased.

As shown in Table 3, TBSA and age were identified from the analysis as been associated with mortality. Thus, a decrease in

**Table 2**  
Cross tabulation of variables.

Age Range * Outcome Cross Tabulation							
Count		Outcome		Total			
		Died	Discharged				
Age Range	60–69 yrs	8	6	14			
	70–79 yrs	10	2	12			
	80–89 yrs	2	2	4			
	90–99 yrs	1	0	1			
Total		21	10	31			
Gender * Outcome Cross Tabulation							
Count		Outcome		Total			
		Died	Discharged				
Gender	Male	8	2	10			
	Female	13	8	21			
Total		21	10	31			
Gender * Aetiology Cross Tabulation							
Count		Aetiology					Total
		Gas	Hot water	Electrical	Bush fire	Hot oil	
Gender	Male	5	1	1	3	0	10
	Female	11	5	0	4	1	21
Total		16	6	1	7	1	31
Aetiology * Outcome Cross Tabulation							
Count		Outcome		Total			
		Died	Discharged				
Aetiology	Gas	13	3	16			
	Hot water	1	5	6			
	Electrical	1	0	1			
	Bush fire	5	2	7			
	Hot oil	1	0	1			
Total		21	10	31			
Range TBSA * Outcome Cross Tabulation							
Count		Outcome		Total			
		Died	Discharged				
Range TBSA	1–20%	1	9	10			
	21–40%	9	1	10			
	41–60%	7	0	7			
	61–80%	3	0	3			
	81–100%	1	0	1			
Total		21	10	31			

**Table 3**

Logistic regression for outcome predictors of burns in older adults.

	Coefficients	Std. Error	t value	P-value
(Constant)		0.487	3.532	0.000
TBSA	−0.016	0.003	−6.045	0.000
AGE	−0.012	0.007	−1.764	0.002

TBSA and age may be associated with better outcomes. This implies that increasing TBSA and age are associated with higher mortality rates among older burned clients.

#### 4. Discussion

Stylianou, Buchan and Dunn [14] described burns as injuries caused by heat, electricity, radiation or corrosive substances to the skin and can occasionally affect the lungs and airways. Burn injuries have been noted to affect every age group, ethnicity and occupation. Thus, as shown in this study, adults aged 60 years and above are equally affected by burns. It was also evident that among the patients, burn injury appeared to be more prevalent among those aged 60–69 years and majority of the older adults were engaged in farming activities. As thermal burns resulting from bush fires affected a substantial number of older adults, it may be deduced that aside domestic burns, farming practises also predisposed an individual to thermal burns. In addition, more females (67.7%) were admitted with burn injuries as compared to men and that could suggest gender variation in burn injuries. In relation to a previous study, Pham et al., [15] assessed epidemiology and outcomes of burn in older adults and observed that older adults within the 55–64 age category recorded the highest number of burn injuries ( $n = 9411$ ). In contrast, Pham et al., [15] noted from their study that males outnumbered females (1.4:1). Stylianou, Buchan and Dunn [14] however observed in their 2003–2011 epidemiological burns study in England and Wales that more females were admitted with burn injury as compared to their male counterparts. Duci et al., [16] also reported a slightly greater number of females ( $n = 29$ ) been admitted with burn injury as compared to males ( $n = 27$ ) in their study undertaken at Kosovo. These contrasting findings may suggest geographical variations in terms of gender distributions of burn injuries.

Despite more females been admitted with burn injuries, mortality was higher among older male adults affected by burn injury. In relation, Benito-Ruiz et al., [17] and Koupil et al., [18] reported similar variation in their studies as they noted higher male mortality among the older adult population; a feature which was absent among younger burn patients. However, a reason for this variation is beyond the scope of this study and warrants further research.

Generally, increasing age and TBSA have been associated with increased mortality rates. For instance, Brusselsaers et al., [2] noted that by adding data of older adults to a mortality risk correlation test, a prominent value was noted ( $r = 0.646$ ;  $P < .001$ ). This indicates that increasing age is associated with increased mortality risk. In addition, they noted that mean %TBSA was higher among deceased burned patients. Based on the regression analysis carried out in this study, age and %TBSA also emerged as significant outcome predictors. This may explain why some older adults in this study affected by thermal burns died. This may be related to the higher %TBSA associated with flame burns. Brusselsaers et al., [2] observed that a mean %TBSA of 22% or higher among older adults may be associated with significant mortality levels. The mean %TBSA in this study was noted as 37.39% which is higher as compared to the assertion by Brusselsaers et al., [2] and this may aid our understanding of the increasing mortality rates among older burn patients. Mortality rates are even higher in low and middle

income countries due to lack of specialised burns centres and poor first aid management [19]. Even with similar burn size, Huang et al., [8] indicated that older adults may suffer greater morbidity and mortality than younger patients. This fact is reflected in the study by Adu and Koranteng [9] in which an overall mortality rate of 11.9% was noted among paediatric burn patients ( $n = 1361$ ). Similarly, Haik et al., [1] observed a mortality rate of 35.3% among Israeli older burn patients with that of the paediatric population recording 0.4%. These variations clearly indicate that age may be a major factor in predicting outcomes. Although some authors have argued older adults have a likelihood of being discharged from a burn centre [20], others have indicated that they are likely to die within a year or two after discharge due to various complications such as multiple organ failure [21]. In this study however, a follow up was not conducted on older adults who were discharged from the burns unit. Thus, subsequent studies may consider a longitudinal approach so as to assess the overall mortality among older burn patients.

Flame burns have been consistently recognised as the major cause of burns in the older adult age group [15,20,22]. Bayuo et al., [10] observed from their study involving one hundred burn patients that burns from flames resulting from gas explosion stood out as a major cause of burns. This accounted for 84 (84%) of burn cases from 2013 to 2015. In relation to this study, flame burns resulting from gas explosion and bush fires were the major cause of burns in the older adult population. In addition, most participants in this study are farmers and that may explain the occurrence of bush fires leading to burn injuries. These findings indicate the need to undertake rigorous public education regarding safe farming practises and household LPG utilisation. As agriculture remains a key part of Ghana's economy and engages a proportion of older adults in the country, education on safe farming practices will be very essential.

Aside flame burns, a cross-tabulation that was carried out revealed further variations in terms of the cause of burns. It was identified that scalds were common in the female population and electrical burns were common in the male population. Klosova, Tymonova and Adamkova [23] observed that scald were common among older adults involved in domestic activities such as cooking. As females are mostly involved in domestic activities in Ghana, the incidence of scald injuries among them can be explained by their involvement in these activities. In terms of days on admission, the mean score noted in this study is 12.19 and a median value of 10 days. However, other studies have reported mean days on admission as 18 days [24,25]. This may mean that older adults in this study probably spent fewer days on admission before noting the final outcome (discharge or death).

#### 5. Conclusion

The older adult population are a unique group of individuals who are also affected by burn injury. There appears to be some gender variations in relation to the distribution of burn injury in this group. Despite the findings noted, the study was conducted within a particular tertiary setting and as such findings may be limited to that particular setting. Also, as this study took a retrospective stance, the study was unable to account for the actual outcome of older burn patients who were discharged home. To this end, a longitudinal study may be helpful in assessing the overall outcome of burn injuries in older adults.

As the number of older persons is expected to increase in the country, there may be a need to design appropriate preventive measures to safeguard them from burn injuries. A notable approach could be educating older adults on safe farming practises as well as domestic utilisation of Liquefied Petroleum Gas (LPG)

products. Further studies are warranted in understanding survival variations that exist between male and female older burn patients.

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### Declarations

All authors have made substantial contributions.

The manuscript, including related data, figures and tables has not been previously published and is not under consideration for publication elsewhere.

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