

## Patterns of Burn Injuries in Ayder Comprehensive Specialized Hospital: a 5-year Retrospective Study, Mekelle, Ethiopia.

Mizan Kidanu<sup>\*1</sup>, Fasika Amdesilase<sup>1</sup>, Aregawi Kassa<sup>1</sup>, Yohannes Tadelle<sup>1</sup>, Meheret Befekadu<sup>1</sup>

<sup>1</sup>School of Medicine, College of Health Sciences, Mekelle University, Mekelle, Ethiopia

\*Corresponding author

### ABSTRACT

**Background:** Burn injuries constitute major public health problems and are the leading cause of significant morbidity and mortality worldwide. There is paucity of published data on burn injuries in the country, particularly in the study area. The aim of this study is to describe the pattern and evaluate the management outcomes in our local area.

**Objective:** The objective of the study was to investigate the patterns of burn injuries in Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia.

**Methods:** This retrospective cross-sectional descriptive study is done on charts of patients admitted with burn injury to Ayder Comprehensive Specialized Hospital, Department of Surgery, Burn Unit, from January 1, 2010 to December 31, 2014. Data were obtained from medical records using pretested structured questionnaire and analyzed using SPSS version 16.

**Results:** A total of 450 burn records were analyzed. The mean ( $\pm$  SD) age was 15.78 ( $\pm$ 13.06) years ranging from 4 months to 78 years. Males 298(66.2%) were mainly affected than females 152(33.8%), giving to a male to female ratio of 2:1. Children aged 0-10 years were the majority accounting for 206(45.8%). Scald was the most common cause of burn injury 226(50.2%), followed by electrical 140(31.1%) and flame burns 82(18.2%). Majority of patients 409(90.9%) sustained second-degree burn and most accidents occurred at home 251(55.8%). Conservative treatment was given to 285(63.3%). Skin grafts and flaps were done for 45(10.0%) cases and different levels of amputations were performed in 23(5.1%) patients. Most 360(80.0%) of the patients were discharged improve, 56(12.4%) went against medical advice and 27(6.0%) patients died.

**Conclusion:** Burn injuries, particularly electrical burns, remain a menace in our environment with unacceptable morbidity, devastating disabilities and mortality. The indications for IV antibiotics also require investigation to avoid unnecessary administration and subsequent drug resistance. There is a need for critical appraisal of the preventive measures and management principles currently being practiced.

**Keywords:** *burn injuries, patterns, Mekelle, Ethiopia*

## Introduction

Burn is defined as an injury to the skin or other organic tissue caused by thermal trauma. Injuries to the skin or other organic tissues due to radiation, radioactivity, electricity, friction or contact with chemicals are also considered as burns [1].

Burn injuries are one of the major public health problems. Worldwide it is estimated that each year over 300 000 people die from fire-related burn injuries. The vast majority (over 95%) of fire-related burns occur in low- and middle-income countries [2].

Burn injuries are a major cause for hospitalization and are associated with significant morbidity and mortality [3]. Non-fatal burns are the leading causes of morbidity, including prolonged hospitalization, disfigurement and disability, often with resulting stigma and rejection [4].

Burn care has a significant financial burden both on the hospital and the patient's family. [2, 4]. The outcomes of burn treatment in the developing world are made worse because of the limited resources. As a result of this and other contributing factors it is not uncommon to see burn injuries causing unacceptably high morbidity and mortality in low income nations [5].

A community based study in Northern Ethiopia, Mekelle Town showed the annual incidence in burns to be 1.2%. Burn had the highest incidence among children less than 5 years old (4.8%) [6]. But a similar study on

a community served by Attat Hospital, Ethiopia showed the incidence of burn to be 5-11%. A systemic review done in Addis Ababa, Ethiopia also indicated burn injuries to account for 5.1% of traumas [7, 8]. Although burn prevention is included among the WHO recommended primary health care topics burn prevention and first aid is often neglected in the training of community health workers in our setting [9, 10].

The management of burn poses a significant challenge for resource poor countries like Ethiopia. Fortunately, burn injuries are preventable. Studies that determine the magnitude and risk factors are the basis for planning preventive measures and establishing burn care facilities [2]. However, few data exist in our setting regarding the epidemiology of burn injuries. Hence, this study will help in describing the patterns of burn injuries and contribute in formulating the strategies of preventing burn injuries.

## Materials and methods

**Study Area and Period:** The study was conducted in Ayder Comprehensive Specialized Hospital from January 1, 2010 to December 31, 2014.

**Study Design:** A five-year retrospective cross-sectional study was employed among 450 patients who sustained burn injury and were admitted to Ayder Comprehensive Specialized Hospital during the study period with total enumeration.

**Data Collection:** A pretested data extraction checklist was employed to collect data by trained data collectors.

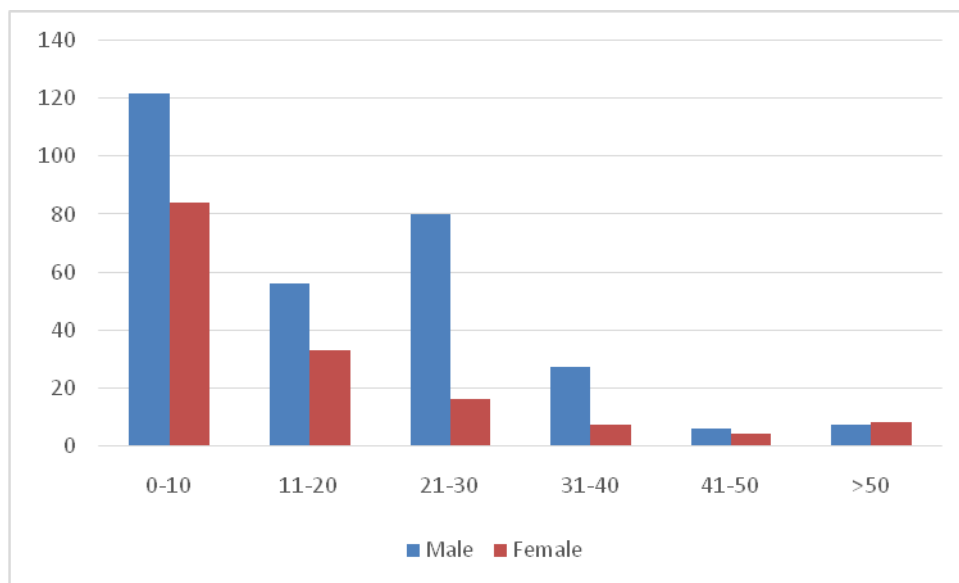
**Data Analysis:** Data were entered into the Epi info and transferred to SPSS for further cleaning, and analysis. Descriptive statistics of frequency and percentage were used to describe categorical variables. Cross tabulation was used to see the distribution of two categorical variables.

**Ethics:** Ethical clearance was obtained from the Research Council of the College of Health Sciences of Mekelle University.

## Result

### *Patient characteristics*

A total of 450 burn injury patients were admitted and managed in the burn unit during this study period, an average of 90 cases per year. Males and female accounted for 298(66.2%) and 152(33.8%), respectively, making a male to female ratio of 2:1. Their age ranged from 4 months to 78 years with a mean ( $\pm$ SD) age of 15.78 ( $\pm$ 13.06) years. The most commonly affected age group was 0-10 years 206(45.8%), followed by 21-30 years 96(21.3%) and 11-20 years 89(19.8%) (Figure 1).



**Figure 1:** Distribution of burn injuries by age and sex among patients from Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia, 2010-2014 (n = 450).

Of the total cases, 302(67.1%) were urban dwellers while 148(32.9%) were from rural

areas. Majority of the patients, 426(94.7%) were from Tigray Regional State and the rest

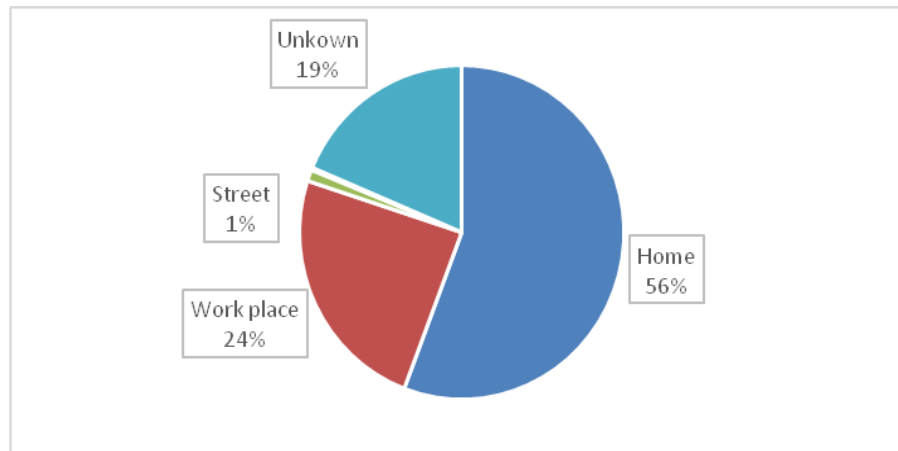
from Afar and Amhara. About 305(67.8%) patients were self-referred while 145(32.2%) were referred from other health institutions.

Most of the patients, 437(97.1%) did not have known medical illness. Only 13(2.9%) cases had known co-morbidities like seizure disorder in 10(2.2%), unspecified mental illness in 2(0.4%) and diabetes mellitus in 1(0.2%) patient.

Minor seasonal variations were observed. In Spring (Tsedey) 125(27.8%), Summer (Keremt) 124(27.5%), Winter (Bega) 107(23.8%) and Autumn (Belg) 94(20.9%) cases were seen.

### *Circumstance of injury*

Majority of burn injury, 251(55.8%) accidents occurred at home. One hundred and nine (24.2%) patients sustained burn injury at work place, 5(1.1%) in the outdoors and in 84(18.8%) patients the place of accident could not be established. Most scald 186/226(82.3%) and 40(48.8%) flame burns happened at home while the majority of electrical burns 84/140(60.0%) occurred at work place (Figure 2).



**Figure 2:** Place of accident of burn injuries from Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia, 2010-2014 (n = 450).

Scald was the commonest cause of burn occurring in 226(50.2%), followed by electrical 140(31.1%), flame 82(18.2%), chemical 4(0.9%), contact 4(0.9%) and inhalational 1(0.2%) burns. Scald burn mainly affected patients aged 0-10 years

182/226(80.5) while electrical burn was predominant in the age group 21-30 years 66/140(47.1%). Flame burn was more prevalent in the age range 11-20 years 25/82(30.5%). There was no documented radiation injury (Table 1).

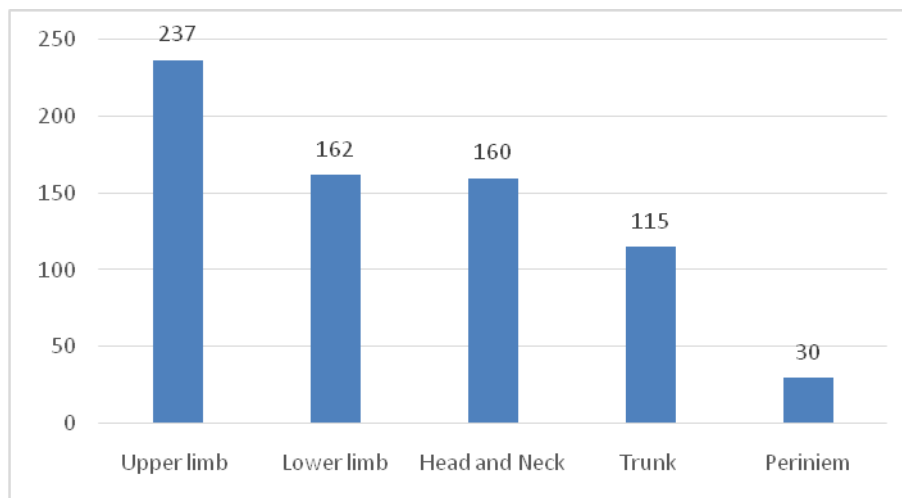
**Table 1:** Causes of burn injuries among patients from Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia, 2010-2014 (n = 450).

Age, yrs	Causes of burn injury								Total, n(%)
	Scald	Flame	Electrical	Chemical	Contact	Inhalational	Radiation	Others	
0-10	182	17	6	0	1	1	0	0	206 (45.8)
11-20	23	25	42	1	1	0	0	0	89 (19.8)
21-30	8	21	66	2	2	0	0	0	96 (21.3)
31-40	9	6	18	1	0	0	0	0	34 (7.6)
41-50	1	5	4	0	0	0	0	0	10 (2.2)
> 50	3	8	4	0	0	0	0	0	15(3.3)
<b>Total, n (%)</b>									450 (100)

**Clinical characteristics**

The upper extremity was the most commonly involved body region

237(52.7%), followed by the lower limb 162(36%), head and neck 160(35.6%) and trunk in 115(25.6%). The perineum area was the least involved 30(6.7%) (Figure 3).

**Figure 3:** Anatomic region involved in burn injuries among patients from Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia, 2010-2014 (n = 450).

The TBSA ranged from 1.0% to 70.0% with a mean of 14.0%. Patients presenting with <10.0% of TBSA accounted for 197(43.7%). Majority of patients 409(90.9%) sustained second-degree burn. The remaining patients had third-degree 33(7.3%) and fourth-degree burn 8(1.8%).

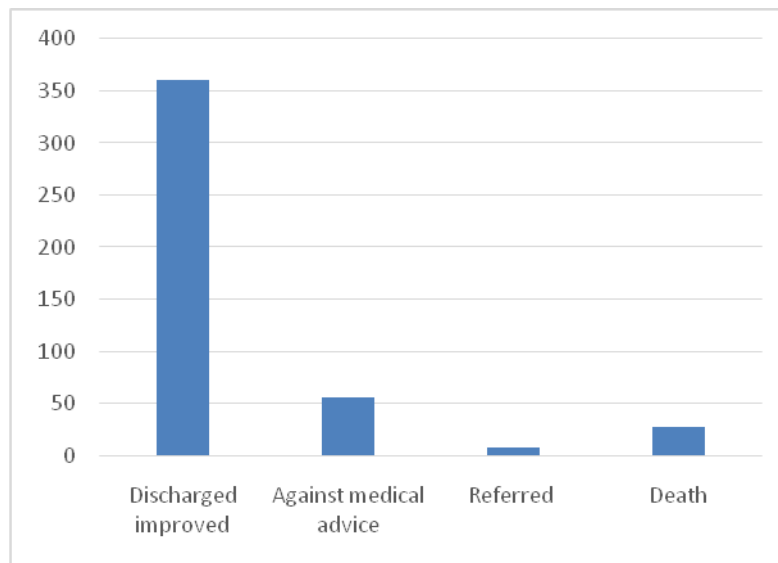
**Treatment parameters**

Two hundred and eight-five (63.3%) patients were resuscitated with intravenous fluids. Around 337(74.9%) patients received analgesics. Only 138(30.7%) cases were given TAT. Wound care with topical antibiotics and honey were given to 352(78.2%) and 3(0.7%) patients. IV antibiotics were administered in 273(60.7%) patients. Surgical procedures including skin

graft & flaps and different levels of amputation were performed in 45(10.0%) and 23(5.1%) of patients, respectively. Nineteen of the 23 patients who had amputations (82.6%) were secondary to electrical burn injuries. Only 14(3.1%) cases received physiotherapy.

**Clinical outcomes**

The overall length of hospital stay ranged from 1 to 515 days with a median of 13 days. About 190(42.2%) patients were discharged within 10 days while 122(27.8%) were hospitalized for more than one month. Most 360(80.0%) patients were discharged improve, 56(12.4%) went against medical advice, 7(1.6%) were referred for better management while 27(6.0%) patients died (Figure 4).



**Figure 4:** Outcomes of burn injuries among patients from Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia, 2010 - 2014 (n = 450)

## Discussion

Burn injuries continue to be major public health problems responsible for significant morbidity and mortality in Ayder Comprehensive Specialized Hospital which is similar to other studies [2].

In this study, males were predominantly affected (66.2%) than females (33.8%) giving a male to female ratio of 2:1 which is in agreement with the reports from Nigeria, Kenya, Saudi Arabia and Israel [11-17]. An American report of national burn repository also indicated 69% of the sufferers were males [18].

The majority of patients in this study were aged between 0-10 years (45.8%). A community based study in Mekelle town, Northern Ethiopia showed the incidence in children under five to be 4.8% [6]. Other hospital based studies from Africa and the Middle East also demonstrated similar results [5, 7, 11, 16, 19 – 21]. The high incidence of burn injuries in children reflects unawareness for dangerous substances, poor supervision, lack of domestic safety measures, playing and the natural curiosity in children in this age group.

In our study, nearly 67.1% of the patients were from urban while 32.9% were from rural areas. According to Hemeda et al from Egypt on the Epidemiology of burns admitted to Ain Shams University Burns Unit, Cairo, 70.1% of the cases were also city dwellers [22]. The predominance of urban residents may be because of a better access to the burn unit in addition to the

likely awareness of and better health seeking behaviour of city dwellers. Most of the cases (67.8%) came self-referred as the public might be cognizant of the presence of burn unit in the hospital.

Most of the patients did not have known medical illness (97.1%). There were 10(2.2%) cases with seizure disorder, 2(0.4%) with unspecified mental illnesses and 1(0.2%) diabetic patient. These risk factors were also identified as contributing factors for burn injury in other studies [19]. In one of the Ethiopian studies, clinicians noted epilepsy as a predisposing factor in 29% of adult inpatients [7].

In this review, scald was the commonest cause of burn injury (50.2%), which is similar to other study reports [16 - 17, 19 - 22]. It is the most frequent etiology of burn injury in children <10 years (80.5%). This is comparable to previous reports from Ethiopian studies [6, 7]. Other studies have also described similar findings [3, 14 -16, 19, 21 - 24]. This may be as a result of children spending most of their time at home where most burn injuries occur. In this study, electrical burn was the second common cause of burn injuries (31.1%). An India study also demonstrated electrical burn as the second common cause accounting for 14% of the burn cases [25]. Males were mainly affected by electrical burn (93.6%) which is consistent with other studies [16, 26 – 28]. This could be because of males being more adventurous than females. Electrical burn affected mostly adults between 21-30 years (47.1%) who are

probably engaged in work place activities which is in agreement with other studies [17, 26 – 27]. However, most studies from Ethiopia and elsewhere reported electrical burn to be the least cause [6, 7, 11 - 12, 14 - 20, 22 - 24, 29]. The possible explanations for the commonness of the electrical burn injury could be the less safety measures in construction sites and inexperience of individuals in handling electricity. In this study, flame burn was more prevalent in the age group of 11-20 years (30.5%) which is in accordance to the finding from India [29].

In the present study, most of the accidents occurred at home (55.8%) followed by were at work place (24.2%). About 81.9% of scald burns and 48.8% of flame burns were sustained at home. Similar studies done in Ethiopia and elsewhere also showed comparable results [6 - 7, 11 - 12, 14, 16 - 19, 22 – 23]. This may be result of boiling fluids for various purposes and routine cooking are mainly taking place at home. Most of the electrical burns occurred at a work place (60.0%) affecting mainly males which is consistent with the reports from Cairo, Saudi Arabia and China [17, 22, 27 - 28]. This could be because of the involvement of males largely in outdoor activities.

In our study, the upper extremity was most frequently injured part of the body (52.7%), followed by the lower limb (36%). The perineum was the least affected anatomic region which is similar to other studies [14, 17, 19, 30].

In this study, the TBSA ranged from 1.0% to 70.0% with a mean TBSA of 14.0%. An observational study from Central Malawi also made the same remark with a mean TBSA of 14.1% and a range of 1%-76% [20]. Other related studies also noted similar findings [15, 24, 17]. In this report, patients admitted with <10.0% of TBSA burn accounted for 43.7%. According, the report from Saudi Arabia and America 51.2% and 74% of the reported TB SA sizes were involved in <10.0% TBSA, respectively [17, 18]. Forjuoh, in a review of burns in low and middle-income countries, found most patients sustained <10% TBSA [19]. Other studies also indicated equivalent reports [11, 15, 20]. Majority of the patients sustained a second-degree burn (90.9%). A hospital-based study at Kenyatta National Hospital, Nairobi, also showed a similar result [14].

In this review, most of the patients were managed conservatively (63.0%) with IV fluids, analgesics, TAT, IV antibiotics, wound care with topical antibiotics and physiotherapy. Surgical procedures including skin grafts & flaps were done in 10.0% of patients while amputations were performed in 23 cases. Most of the amputations were done for electrical burn injury (82.6%) as a result of the severe soft tissue damage. Similar results were appreciated in studies from Saudi Arabia and China [17, 27, 28].

The overall length of hospital stay ranged from 1 to 515 days with a median of 13 days. About 42.2% of the cases were discharged within 10 days of admission



while 27.8% were hospitalized for >30 days. This is consistent with the previous study findings in Ethiopia and a Malawi [7, 20]. But a longer hospital stay was observed in Yekatit-12 Hospital, Addis Ababa, Ethiopia with an overall median hospital stay of 44 days [24]. The shorter length of hospital stay noticed in our study could be because most cases had smaller percentage of TBSA involved with a lesser depth of burn injury.

The majority (80%) of the patients were discharged improved while 12.4% went against medical advice for unknown reasons. The overall mortality was 6.0% which is lower compared to reports from Ethiopia, some African and Asian countries [11 - 13, 15, 19 - 20, 24 - 25, 29]. This could be as a consequence of the smaller TBSA size in many patients. Previous studies from developed countries indicated a much lower mortality rate [1, 2, 4, 16, 18].

### Conclusion

This study showed burn injuries are common public health problems. Children and young adults are the primary victims. Majority of burn accidents occur at home with scald being the commonest cause. Electrical burns were mainly observed at work places. A large number of electrical burn injuries with subsequent devastating disabilities were observed. This requires further research to identify the reasons and formulate solutions to prevent these injuries. The indications for IV antibiotics also require requisitions to avoid unnecessary administration and subsequent drug resistance Burn injuries should be prevented

through public education on safety measures and essential precautions.

### Conflict of interest

The authors declare that they have no conflict of interest.

### Funding

This research was sponsored by the College of Health Sciences of Mekelle University.

### Author contributions

MK, FA, AK, YT and MB were involved in data collection, analysis, interpretation of the data, designing and developing the manuscript. All authors have approved the manuscript.

### Acknowledgement

The authors acknowledge the staffs of the burn ward for their dedicated patient care, the hospital administration and the college of health sciences for providing the opportunity to pursue our research. Special thanks to Dr Mekonnen Hagos, Assoc Prof of Urology, CHS-MU for his valuable comments during the write up of the manuscript.

### References

1. Peden M, Oyegbite K, Ozanne-Smith J, Hyder AA, Branche C, Rahman AKMF, et al (eds). World report on child injury prevention: Burns. *WHO*, Geneva. 2008;79.
2. Mock C, Peck M, Peden M, Krug E (eds). Burn plan: A WHO plan for burn

- prevention and care. *WHO*, Geneva. 2008;2.
3. Albertyn R, Bickler SW, Rode H. Pediatric burn injuries in Sub Saharan Africa - an overview. *Burns*, 2006;32:605-612.
  4. Elbie M. Critical care of burn patients in developing countries: cost Vs need. *CME*, 2008;26:428-430.
  5. Mock CN, Adzotor E, Denno D, Conklin E, Rivara F. Admissions for injury at a rural hospital in Ghana: Implications for prevention in the developing world. *Am J Public Health*, 1995;85:927-931.
  6. Kidanu EN, Bernt L. Epidemiology of burn injuries in Mekele Town, Northern Ethiopia: A community based study. *Ethiop J Health Dev*, 2002;16(1):1-7.
  7. Courtright P, Haile D, Kohls E. The epidemiology of burns in rural Ethiopia. *J Epidemiol Community Health*, 1993;47:19-22.
  8. Azaj A, Seyoum N, Nega B. Trauma in Ethiopia Revisited: A systematic Review. *East Cent Afr J Surg*, 2013;18(2):108-118.
  9. World Health Organization. The primary health care worker. *WHO*, Geneva. 1980;99-106.
  10. McLughan. A simple guide to burn epidemiology. *Burns*, 1995;12(3):217-220.
  11. Jiburum BC, Olaitan PB. Burn injuries in Enugu, Nigeria: *Niger J Surg*, 2005;7(3-4):271-273.
  12. Andrew ED, Eshobo EI, Lilian OO, Charles EO, Christopher EI, John EOS. A five-year review of burn injuries in Irrua, Nigeria. *BMC Health Serv Res*, 2007;7:171.
  13. Maurice EA, Ekpo R, Ogbu N, Agbor C. A Prospective Study of Burn Trauma in Adults at the University of Calabar Teaching Hospital, Calabar (South Eastern Nigeria): *Eplasty*, 2008;(8):370-376.
  14. Ndiritu S, Ngumi ZWW, Nyaim O. Burns: The Epidemiological Pattern, Risk and Safety Awareness at Kenyatta National Hospital, Nairobi. *East Afr Med J*, 2006;83 (8):455-460.
  15. Nthumba PM, Oliech JS. Outcome of moderate and severe thermal injuries at Kenyatta National Hospital: *East Cent Afr J Surg*, 2005;10(2):38-42.
  16. Haik J, Liran A, Tessone A, Givon A, Orenstein A and Peleg K. Burns in Israel: demographic, etiologic and clinical trends, 1997-2003. *Isr Med Assoc J*, 2007; 9(9):659-662.
  17. Mustafa HA. Pattern Of Burn Injuries At King Fahad Hospital, Al-Baha: A Study Of 277 Cases. *Ann Saudi Med*, 1997;17(1):104-107.
  18. American Burn Association, *National Burn Repository*, 2014. Version 10.0.
  19. Forjuoh SN. Burns in low- and middle-income countries: A review of available literature on descriptive epidemiology, risk factors, treatment, and prevention. *Burns*, 2006;32:529-537.
  20. Samuel JC, Campbell ELP, Mjuweni S, Muyco AP, Cairns BA, Charles AG. The Epidemiology, Management, Outcomes and Areas for Improvement of Burn Care in Central Malawi: An

- Observational Study. *J Int Med Res*, 2011;39:873-879.
21. Rayner R, Prentice J. Pediatric burns: A brief global review. *Wounds*, 2011;199(1):39-46.
  22. Hemeda M, Maher A, Mabrouk A. Epidemiology of burns admitted to Ain Shams University Burns Unit, Cairo, Egypt. *Burn*, 2003;29(4):353-358.
  23. Justin-Temu M, Rimoy G, Premji Z, Matem G. Causes, Magnitude and Management of Burns in Under-Fives in District Hospitals in Dar Es Salaam, Tanzania: *East Afr J Public Health*, 2008;5(1):38-42.
  24. Mulat T, Salemark LO. Description of patients admitted to a burn unit of Yekatit 12 Hospital, Addis Ababa, Ethiopia. *Ethiop Med J*, 2006;44(4):369-375.
  25. Umar BAA, Ahmad NA. Pattern of Thermal Burn Case Incidences Studied at a tertiary care hospital in Sasaram, Bihar. *Indian J Forensic Community Med*, 2015;2(3):130-134.
  26. Luz DP, Millan LS, Alessi MS, Uguetto W, Paggiaro, Gomez DS, et al. Electrical burns: a retrospective analysis across a 5-year period. *Burns*, 2009; 35(7):1015-9.
  27. Quan L, Ling-Feng W, Qiang C, Shu-Jie W, Fang L, Te B. Amputations in the burn unit: A retrospective analysis of 82 patients across 12 years. *Burns*, 2017;43:1449-1454.
  28. Li H, Tan J, Zhou J, Yuan Z, Zhang J, Peng Y, et al. Wound management and outcome of 595 electrical burns in a major burn center. *J Surg Res*, 2017;214:182-189.
  29. Shanmugakrishnan RR, Narayanan V, Thirumalaikolundusubramanian P. Epidemiology of burns in a teaching hospital in south India: *Indian J Plast Surg*, 2008;(41):34-37.
  30. Ziad AB, Thekraiat MAQ, Hamzeh AB, Muhmammad RK. Pattern of burn injury at north of Jordan. *Int J Burn Trauma*, 2018;8(1):1-5.