PRINT ISSN 1119-8362
Electronic ISSN 2659-1499

Full-text Available Online at
https://www.ajol.info/index.php/jasem
https://www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage.
Vol. 28 (8) 2367-2373 August 2024

Impact of Inhalation Injury on Burn Outcome and Challenges of Burn Care in Selected Adult Major Burns Patients Treated at a Tertiary Institutional Teaching Hospital in Benin City Edo State, Nigeria

[1]ELIMIAN, HO; [2]ELIMIAN, FE

*[1]*Department of Surgery, College of Medical Sciences, Edo State University Uzairue, Edo State, Nigeria.*
[2]Department of physiology, University of Benin, Benin City, Nigeria

Corresponding Author Email: oguekhian@gmail.com
Tel: +2348026224676

Co-Author Email: faithelimian@gmail.com;
ORCID: https://orcid.org/0009-0008-4428-139X;
Tel: +2347038143780

ABSTRACT: Burn injury is a major trauma which range from minor burns to major burns. Burns are the fourth most common type of trauma worldwide. Major burns have been known to have fatal outcomes. Hence, the objective of this paper was to evaluate the impact of inhalation injury on burn outcome and challenges of burn care in selected adult major burns patients treated at a Tertiary Institutional Teaching Hospital in Benin, City Edo State, Nigeria over a 12 months period using sixty patients of 28 males and 32 females with a male to female ratio of 1; 1.14. Upon patients' arrival, they were resuscitated. The burn size and the burn depth were estimated. Burn size was estimated using The Lund and Browder chart. The depth of the burn was assessed clinically. These were documented in charts and graphs. Thirty two patients (53.3%) presented in the hospital within 4 hours of burns. Seven patients (11.7%) presented between 5-8hours while 21(35.0%) presented after 8hours. Mortality rate was more in patients with inhalation injury (62.5%) as compared to those without (14.3%). This finding was found to be statistically significant ($P < 0.001$). Flame burn accounted for the highest aetiological agent with Kerosene explosions as the commonest cause. In conclusion, flame burns were the commonest aetiological factors in burns. Inhalation injury was a significant risk for death in patients with major burns.

DOI: https://dx.doi.org/10.4314/jasem.v28i8.13

Cite this Article as: ELIMIAN, H. O; ELIMIAN, F. E. (2024). Impact of Inhalation Injury on Burn Outcome and Challenges of Burn Care in Selected Adult Major Burns Patients Treated at a Tertiary Institutional Teaching Hospital in Benin City Edo State, Nigeria. *J. Appl. Sci. Environ. Manage.* 28 (8) 2367-2373

Dates: Received: 04 June 2024; Revised: 27 June 2024; Accepted: 11 July 2024 Published: 05 August 2024

Keywords: Inhalation injury; Mortality; Scald; Flame; Major Burns

Burn injury is a major trauma. It ranges from minor and superficial burns to very extensive and full thickness burns affecting a large body surface area (Klein, 2014). Major burns affect every organ of the body with the skin being the largest organ affected (Michael and Sudip, 2008). Historically, severe burns have been known to have fatal outcome. Prompt resuscitation measures, as well as early burn wound excision and skin grafting, improved ventilatory and organ support, have improved the chances of survival in burn patients (Baxter and Shires, 1968) and (Jonathan *et al.*, 2015). Burns are the fourth most common type of trauma worldwide, after vehicular crashes, falls, and injuries resulting from interpersonal violence. (World Health Organization, Geneva 2008). A large proportion of patients with burns live in low to middle income countries in about 90 percent of cases. These regions lack the basic infrastructure and

*Corresponding Author Email: oguekhian@gmail.com
Tel: +2348026224676

facilities needed to prevent burns (Murray and Lopez, 2006) and (Peck and Pressman, 2013). Cooking is the commonest activity associated with burn injuries occurring in the domestic setting (Center for Disease Control, 2008) and (Attia, 1997). Burns in the paediatric age group occur commonly in the home setting in about 84 percent of cases. Of these cases, about 80 percent of the children are usually unsupervised by parents and scald is commonest in this age group (Forjuoh, 2006) and (Rossi *et al.*, 1998). Adult burns can occur at home, outdoors or at work. Adult females commonly sustain their burns at home, while burns in adult males are associated with occupational exposure (Hemeda *et al.,* 2003) and (Davies, 1990). While majority of burns are minor and may require outpatient treatment: major burns defined as partial thickness burns greater than 15% and 10% of Total Body Surface Area for adult and children respectively or full thickness burns greater than 7.5% and 5% for adult and children respectively, will require admission into a burn centre. Patients who suffered burns to special areas like facial burns, burns to the hands, feet, genitalia, perineum, burns across major joints, electrical burns, chemical burns and inhalation injury will require in-patient care in a burn centre (Akpuaka, 2009). In addition, patients with significant co-morbidities will be candidates for hospital care (Janzekovic, 1970).

Major burn carries high mortality and morbidity. Hence the need to document our experiences with burn cares. The objective of this study is to highlight the impact of inhalation injury on burn outcome and also outline the challenges of burn care in a poor resource setting.

MATERIALS AND METHODS

Sample Collection: The study population was drawn from adult patients admitted into the Burns ward and the Burns intensive care unit of University of Benin Teaching Hospital (U.B.T.H.). These patients were persons who suffered major burns necessitating admission. This was a cross sectional prospective study of 60 adult patients who suffered major burns and consented to the study. This involved the evaluation of patients managed for major burn and the evaluation of the outcome over a 12 months period (February 2019 to January 2020).

Sample size was computed using Fischer's formula (Fisher *et al.*, 1970).

$$n = \frac{z^2 pg}{d^2} \quad (1)$$

Where Z = standard normal deviation usually set at 1.96 (which corresponds to 95% confidence level)

There was no data on prevalence of burn in Benin City. Hence, it was calculated using the total number of trauma and burn patients treated in University of Benin Teaching Hospital (U.B.T.H.), Benin City, in 2015.

$$\text{p} = \text{prevalence} = \frac{\text{TNBP}}{\text{TNTP}} \quad (2)$$

Where TNBP = total number of burn patient treated in UBTH in 2015; TNTP = total number of truma patients treated in UBTH in 2015; p = 105/2610; p = 0.04 (prevalence of burns in U.B.T.H. for 2015); q is defined as 1-p, where p is prevalence; d = degree of accuracy desired (usually set at 0.05).

$$q = 1 - p = 0.96 \quad (3)$$

$$n = \frac{1.962\text{x } 0.96 \text{ x } 0.04}{0.052} = 55.4 \quad (4)$$

Attrition of about 10% was added to make the total size 60 patients.

Ethical clearance was obtained from the Ethics Committee of the University of Benin Teaching Hospital.

This study involved patients admitted into the burns ward and intensive care unit for major burns. This included adult male and female patients of 18 years to 65years. Upon patients' arrival at the emergency, they were resuscitated.

The burn size and the burn depth were estimated. Burn size was estimated using The Lund and Browder chart. The depth of the burn was assessed clinically by the burn wound appearance, capillary blanching and refill, as well as burn wound sensitivity to light touch and pinprick. The serum C - reactive protein (CRP) was assayed for. These were documented in charts and graphs.

RESULTS AND DISCUSSION

Sixty patients were studied. This included 28 males (46.7%) and 32 females (53.3%) with a male to female ratio of 1; 1.14. Thirty one percent of these patients were from Edo ethnicity 31(51.7%) Igbos 12(20.0%), Yorubas were 11.6%. thirty four patients (56.7%) of the patients had Tertiary educational level, 27 patients (45%) had secondary education and 5 (8.3%) had primary education as shown in table 1 . Thirty two patents (53.3%), presented in the hospital within 4 hours of burns. Seven patients (11.7%) had a presentation interval of between 5-8hours while

21(35.0%) presented after 8hours. The mean presentation interval is 7hours, 20 minutes.

Table 1: Showing Patients' Bio data (n = 60)

Variables	Tenets	Frequency	Percent
Sex	Male	28	46.7
	Female	32	53.3
Ethnicity	Edo	31	51.7
	Ibo	12	20.0
	Yoruba	7	11.6
	Others	10	16.7
Occupation	Civil Servant	22	36.7
	Trader	6	10.0
	Student	10	16.7
	Others	22	36.7
Marital status	Single	23	38.3
	Married	34	56.7
	Cohabiting	1	1.7
	Widowed	2	3.3
Educational level	Primary	5	8.3
	Secondary	27	45.0
	Tertiary	28	46.7

The commonest site of burn was at home 50(83.3%), 10% of the burns were occupation related with 4 patients (6.7%) who were caught up in flames while walking on the road. Majority of the patients 41(68.3%) had burns in an enclosed environment. The commonest pre-hospital treatment was pouring of water on the burnt area 22(36.7%) while 10(16.7%) uses both water and raw eggs and 11 (18.3%) had honey poured on their burn wound. None of the patient had response from a formal emergency service provider prior to presentation at the hospital as shown in table 2. The mean ± SD duration of stay on admission is 19.83 ± 20.013. Most of the cases 27(45.0%) spent less than 10days on admission whereas 13(21.7%) of the cases spent over 30days on admission as shown in table 2.

Table 2: Showing history relating to the burns incidence (n = 60)

Variables	Tenets	Frequency	Percent
Presentation interval	1-4hours	32	53.3
	5-8hours	7	11.7
	>8hours	21	35
	Mean ± SD = 7:20 ± 42.50 hours		
Site	Home	50	83.3
	Work	6	10.0
	Road	4	6.7
Environment	Enclosed	41	68.3
	Not enclosed	19	31.7
Duration of Stay	< 10days	27	45.0
	10-20days	17	28.3
	21-30days	3	5.0
	>30days	13	21.7
	Mean ± SD = 19.83 ± 20.013		
Pre-hospital care	Eggs	3	5.0
	Eggs and water	10	16.7
	Water	22	36.7
	Honey poured on the wound	3	5.0
	Others	11	18.3
	Nil	11	18.3

The commonest aetiologic agent for burns injury was from kerosene explosion 21(35.0%) followed by gas explosion 20(33.3%). Petrol explosion accounted for 18.3%, with hot water /scald 6(10.0%) and corrosive chemicals 2(3.3%) a showed n figure 2. Overall, flame burn as an Aetiological agent, accounted for 86.6% of the total burns

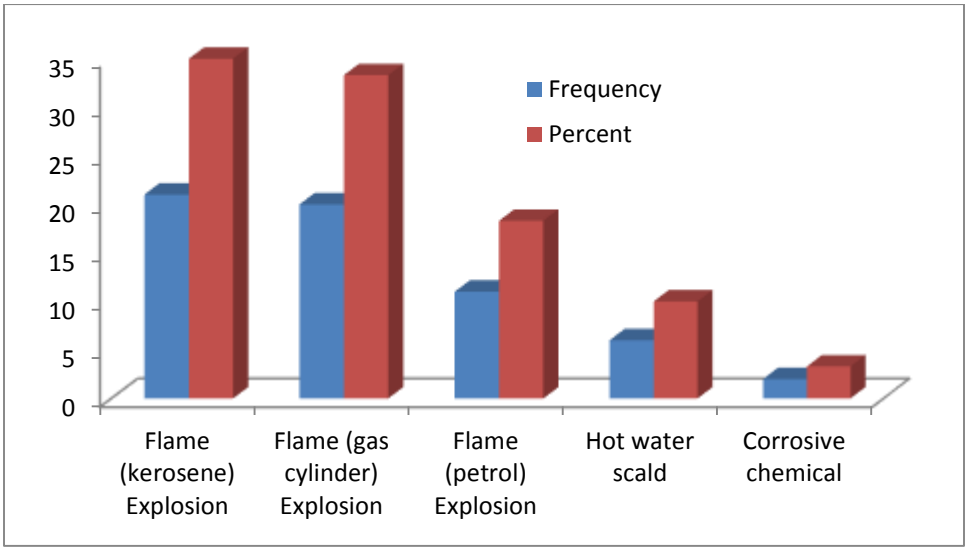

Fig.1: Showing aetiological agents

Table 3: Mean TBSA/DEPTH Values

Body parts	BSA (%)	FT	SPT	DPT
	Mean ± SD	Freq. (%)	Freq. (%)	Freq. (%)
Head and neck	4.5 ± 5.43	7(11.7)	27(45.0)	16(26.7)
RUL	5.5 ± 2.03	22(36.7)	15(25.0)	23(38.3)
LUL	4.7 ± 2.95	16(26.7)	16(26.7)	20(33.3)
AT	6.3 ± 6.15	21(35.0)	11(18.3)	14(23.3)
PT	5.2 ± 6.56	15(25.0)	6(10.0)	7(11.7)
Perineum	0.03 ± 0.18	Nil	Nil	2(3.3)
RLL	7.02 ± 6.12	19(31.7)	10(16.7)	16(26.7)
LLL	7.0 ± 6.47	19(31.7)	11(18.3)	12(20.0)
Total	38.9 ± 22.24	24(38.3)	15(25.0)	21(35.0)

Key: RUL (right upper limb), LUL (left upper limb, AT (anterior trunk), PT (posterior trunk), RLL (right lower limb) and LLL (left lower limb).

More patients suffered full thickness and deep dermal burns in the right upper limbs when compared to the left upper limb as shown in table 3. There was higher percentage of burns involving the anterior trunk (6.3 ± 6.15) with more of full thickness and deep dermal burns as compared to the posterior trunk (table 3).

Patients with past history of diabetics have more mortality rate (50.0%). Also, mortality rate increases with increasing presentation interval. However, none of the above relationships were statistically significant. Furthermore, mortality rate was more among those who sustained burn injury in an enclosed environment (48.8%) as against ((21.1%) from non-enclosed environment. Similarly, mortality rate was more among those who suffered from Inhalation injury (62.5%) as compare to those that did not (14.3%). Both findings were found to be statistically significant at (P = 0.041) and (P < 0.001) respectively (table 4). The mean CRP levels of patients with inhalation injury were higher than those without inhalation injuries at p–value of 0.460 (table 5). The mean body surface area burns plus standard deviation = 38.9 ± 22.24. There were larger burn sizes in the female patients when compared to males (figure 2). However, this was not statistically significant. Mortality was more among female (43.7%) compare to male (35.7%). There was increase in mortality rates with increasing age, but this was no statistically significant (table 4). The mortality was more among the female patients 14(43.7%). This was however, not statistically significant.

Table 4: showing the relationship between some variables and outcome

Variable	Tenets	Outcome		Total	df	χ^2	P- value
		Well (%)	Death (%)				
	Male	18(64.3)	10(35.7)	28(100)		.	
Sex	Female	18(56.3)	14(43.7)	32(100)	1	.402	.526
	< 20years	2(50.0)	2(50.0)	4(100)			
	20 -40years	20(67.0)	9(33.0)	29(100)			
Age group	40-60years	13(50.0)	13(50.0)	26(100)	3	2.888	.409
	> 60years	1(100)	0(0)	1(100)			
	Flame (kerosene) Explosion	11(52.4)	10(47.6)	21(100)			
	Flame (gas cylinder) Explosion	12(60.0)	8(40.0)	20(1000			
Agent	Flame (petrol) Explosion	6(54.5)	5(55.5)	11(100)			
	Corrosive chemical	1(50.0)	1(50.0)	2(100)			
	Hot water scald	6(100)	0(0)	6(100)	4	4.728	.316
Environm	Enclosed	21(51.2)	20(48.8)	41100)			
ent	Not enclosed	15(78.9)	4(21.1)	19(100)	1	4.159	.041*
Inhalation	Yes	12(37.5)	20(62.5)	32(100)			
injury	No	24(85.7)	4(14.3)	28(100)	1	14.464	.000*
Past	Hypertension	3(60.0)	2(40.0)	5(100)			
medical	Diabetic	1(50.0)	1(50.0)	2(100)			
History	PUD	1(100)	0(0)	1(100)			
	Epilesptic	1(100)	0(0)	1(100)	4	2.346	.672
	Nil	29(56.9)	12(43.1)	51(100)			
Presentati	1-4hours	22(68.8)	10(31.2)	32(100)			
on interval	5-8hours	4(57.1)	3(42.9)	7(100)	2	.600	.741
	>8hours	10(47.6)	11(52.4)	21(100)			

Table 5: Relationship between Patients with Inhalation Injuries and Those Without

Mean CRP Level	Inhalation injury		Total	df	χ^2	P- value
	Yes	No				
0.1-10	0(0)	1(100)	1(100)			
10.1-20	3(37.5)	5(62.5)	8(100)	5	4.651	.460
20.1-30	3(75.0)	1(25.0)	4(100)			
30.1-40	1(25.0)	3(75.0)	4(100)			
40.1-50	5(71.4)	2(28.6)	7(100)			
>50	19(52.8)	17(47.2)	36(100)			

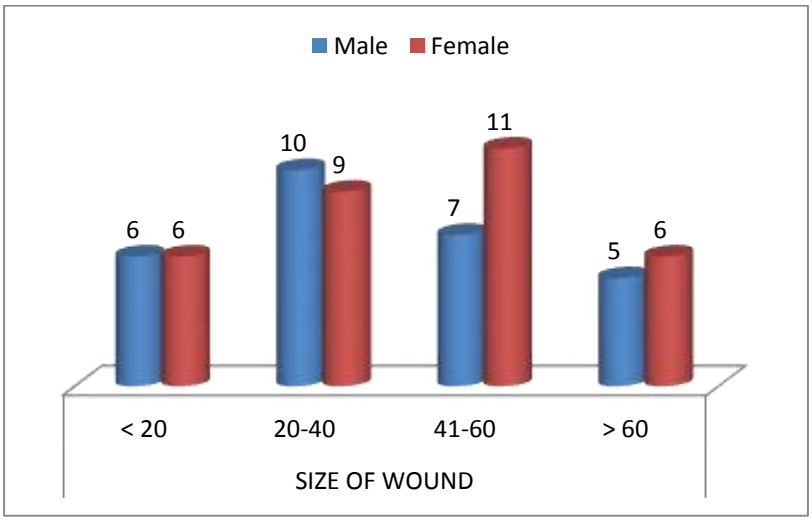

Fig.2: comparing burn sizes between male and female burns patients
Note: *size of burn wound is in percentage.*

Major Burn injury is a cause of disability and death. The aetiological factors of burns include scald, dry heat (flame, hot objects), electricity, chemical caustics and irradiation. Akpuaka, 2009). Studies have shown that the commonest aetiological factor is flame burn in the southern part of Nigeria. Studies by Asuquo *et al.*, (2008) and Oladele *et al*., (2018), showed that flame accounted for 81.3% and 56% respectively of all patients admitted for major burns. This is similar to the findings of this study which flame burns from gas, petrol and kerosene explosions accounted for 86.6% of the study population. Kerosene explosions were the commonest cause of flame burns from this work. A review done by Shehan and Peter (2004), as well as report from the California burn registry, Bongard *et al.*, 1985); also corroborated the findings of our work with flame burns from flames and flammable liquids as the commonest aetiological agent of burn injuries. This accounted for 50% and 44.3% respectively. The higher percentage of patients with flame burns from our work could be from adulteration of petroleum products in the Niger delta region of Nigeria, poor handling of inflammable products and non-adherence to safety measures for burns prevention. Poor power supply may also be a contributing factor resulting in the use of kerosene lantern as well as source of fuel in residential buildings. Proliferation of illegal refineries and poorly refined products from these refineries could be a contributory factor. Scald accounted for 10% of the total study population. This is less than the results gotten from studies by Oludiran and Umebese (2009) and Bongard *et al.*, (1985) which had 38.7% and 24.5% respectively. This may be due to the exclusion of children from this study, which usually constitutes the scald injury population. Most studies reported that more males are affected by burns (Nthumba, 2016) and (Isiguzo *et al.*, 2020). The report from the California burn registry puts the male to female ratio of 2.7: 1 (Shehan and Peter, 2004). The result from this study had a male to female ratio of 1:1.14. The female preponderance may be due to the fact that the most of the burns occurred at home and resulted from cooking with suspected adulterated kerosene. Culturally in Nigeria, women do most of the cooking. Larger burn sizes were also noted in female patients and the mortality in female patients were higher. However, these associations were not statistically significant. Early presentation and resuscitation is vital to patient's survival. Majority of the patients (53.3%) presented within 4 hours of burns while 11.7% presented from 4-8, and the other patients (35.0%) presented after 8hours with overall presentation interval is 7hours, 20 minutes. The findings of this study are similar to the findings of Abubakar, *et al*. in which most of the patients presented within 8 hours of injury (Abubakar *et al.*,

2023). However, the large proportion of patients presenting after 8 hours of burn may be due to the absence of pre- hospital emergency services and poor road network which can delay movement of patients. The commonest pre-hospital treatment received by patients included was pouring of water on the burnt surfaces in 36.7%. This was followed by use of honey and raw eggs. Other substances like sap from plantain stem, cow urine, engine oil and other substances were used. Eleven patients (18.3%) patients had no prior treatment before presenting in the hospital. These finding were as previously documented in previous works (Abubakar *et al.,* 2023) and (Nduagubam *et al.,* 2022). These practices may be due to none availability of pre-hospital emergency services and lack of knowledge amongst the general populace on burn care. Little or no priority is placed on burns care by government despite the impact on mortality and morbidity.

Inhalation injury often occur in flame burns especially in an enclosed environment resulting in inhalation of noxious gases such as cyanide and carbon monoxide, particulate matter in the smoke and other carbonaceous substances You *et al.,* 2014. Majority of the burns occurred at home with majority of them (68.3%) in enclosed environment. The patients managed for inhalation injury were 53% of the study population. This was higher than that from other studies which ranged from 14.2% to 30% (Abubakar *et al.,* 2023) and (Foster and Holmes, 2017). Inhalation injury was a significant risk for mortality with a p - value of < 0.001. This figure is higher than that from other region of the country and beyond due to the adulteration of kerosene and non-adherence to safety protocol. The mortality from this study was 40%. There was higher mortality in females, patients with co- morbidity and inhalation injuries. This was higher than figures from other studies (Abubakar *et al.,* 2023 and Odondi *et al.,* 2020). This higher mortality figure could be due to the higher burn size of the patients in this study (mean body surface area burns plus standard deviation = 38.9 ± 22.24). Non availability of pre-hospital care and the use of substances that may be harmful on the burn wound may also put the patients at risk. The none availability of adequate facilities to intubate and ventilate all patients with inhalation injury may also impact negatively on survival.

Conclusion: In conclusion, flame burns were the commonest aetiological factors in burns with kerosene explosion as highest cause of flame burns. No patient had pre-hospital emergency service/ care. Inhalation injury was a significant risk for death in patients with major burns.

Declaration of Conflict of Interest: The authors declare no conflict of interest.

Data Availability Statement: Data are available upon request from the first author or corresponding author.

REFERENCES

Abubakar, AI; Okpechi, SC; Euguagie, OO; Ikpambese, AA. (2023). Demographics and clinical characteristics of burn injuries in Nigeria: A tertiary hospital cohort. *Nig. J. Clin. Pract.* 26:1916-20.

Akpuaka, FC. (2009). Burns. In: *Principles and Practice of Surgery*, 4th Edition. *(Accra*): Ghana Publishing Corporation. 199-200. 9789964103248 9964103247.

Asuquo, ME; Ekpo, R; Ngim, O; Agbor C. (2008). A Prospective Study of Burn Trauma in Adults at the University of Calabar Teaching Hospital, Calabar (South Eastern Nigeria). *E-plasty*. 8:370-376

Attia, AF; Sherif, AA; Mandil, AM; Massoud, MN; Abou-Nazel, MW; Arafa, MA. (1997). Epidemiological and Sociocultural Study of Burn Patients in Alexandria, Egypt. *EMHJ*. 3 (3): 452-461.

Baxter, CR; Shires, T. (1968). Physiological Response to Crystalloid Resuscitation of Severe Burns. *Ann NY Acad Sci*. 150:874.

Bongard, FS; Ostrow, LB; Susan, T; Sacks, ST; Mcguire, A; Trunkey, DD. (1985). Report from the California Burn Registry The Causes of Major Burns. *West. J Med*. 142: (653-656).

Center for Disease Control. Fire Deaths and Injuries: Fact Sheet Overview 2008. www.cdc.gov/HomeandRecreationalSafety/Fire-Prevention/fires-factsheet.html (Accessed on May 04, 2024).

Davies, JW. (1990). The Problems of Burns in India. *Burns.* S. 1:79-94.

Fisher, AA; Lant, JE; Stogeckel, EJ; Townsen, JW. (1970). In: *Handbook for Family Planning Operation Design*, 2nd edition (Washington DC): Oxford University Press. 45.

Forjuoh, SN. (2006). Burns in Low- and Middle-Income Countries: A Review of Available Literature on Descriptive Epidemiology, Risk Factors, Treatment, and Prevention. *Burns*. 32:529.

Foster, K; Holmes, JH. (2017). Inhalation Injury: State of the Science. *J. Burn Care Res*. 12 (9):1-6.

Hemeda, M; Maher, A; Mabrouk, A. (2003). Epidemiology of Burns Admitted to Ain Shams University Burns Unit, Cairo, Egypt. *Burns*. 29:353.

Institute for Health Metrics and Evaluation. The Global Burden of Disease: 2010 Update. IHME, Seattle, 2012. viz.healthmetricsandevaluation.org/gbd-compare/. (Accessed on May 01, 2024).

Isiguzo, CM; Opara C; Nnadozie, UU; Opara, K. (2020). Burn injury in tertiary health facility in South East Nigeria: A 2 year prospective study. *Burns Open*. 4: 153–157

Janzekovic, Z. (1970). A New Concept in the Early Excision and Immediate Grafting of Gurns. *J. Trauma*. 10 (12):1103-1108.

Jonathan, F; Fred, WE; Nicole, SG. (2015). Burns. In *Schwartz's Principles of Surgery*, 10th edition (New York) McGraw-Hill Education. 227- 228. 978-0-07-180092-1.

Klein, BM. (2014). Thermal, Chemical, and Electrical Injuries. In: *Grabb and Smith's Plastic Surgery*, 7th Edition. (Philadelphia) Lippincott Williams & Wilkins, a Wolters Kluwer business. 127-133.

Michael, T; Sudip, G. (2008) Burns. In: *Barley and Loves Short Practice of Surgery*, 25th Edition. (London): Edward Arnold (Publishers) Ltd. 378-380. 978 0 340 93932 1.

Murray, CJ; Lopez, AD. (2006). The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability from Diseases, Injuries, and Risk Factors in 1990 and projected to 2020, *World Health Organization*, Switzerland. 34-43.

Nduagubam, OC; Mba, UC; Onumaegbu, OO, Onah, II; Chukwubuike, KE; Bisi-Onyemaechi, AI; *et al.* (2022). Paediatric burn injuries in Enugu, South-East Nigeria: A 7-year multi-centre retrospective review. *Burns*. 48:432–9.

Nthumba, PM. (2016). Burn in subsaharan Africa: a review. Burns. 42(2):258–66.

Odondi, RG; Shitsinzi, R; Emarah, A. (2020). Clinical patterns and early outcomes of burn injuries in patients admitted at the Moi Teaching and Referral Hospital in Eldoret, Western Kenya. *Heliyon* 6: e03629: 1-5

Oladele, AO; Olekwu, AA; Babalola, OF; Ibrahim, MH; Babalola, RN. (2018). Burn Injury Patterns and Validation of the Abbreviated Burn Severity Index as a Predictor of Outcome in a Southwestern Nigerian Hospital. *World J Surg Surgical Res.* 1: 1070.

Oludiran, OO; Umebese, P. (2009). Pattern and Outcome of Children Admitted for Burns in Benin City, Mid-Western Nigeria. Indian Journal of Plastic Surgery. 42:189-193.

Peck, M; Pressman, MA. (2013). The correlation Between Burn Mortality Rates From Fire and Flame and Economic Status of Countries. Burns. 39:1054.

Rossi, LA; Braga, EC; Barruffini., RC, Carvalho, EC. (1998). Childhood Burn Injuries: Circumstances of Occurrences and their Prevention in Ribeirão Preto, Brazil. *Burns*. 24:416.

Shehan, H; Peter, D. (2004). ABC of burns Pathophysiology and types of burns. *BMJ*. 328:1427–1429.

World Health Organization. The Global Burden of Disease: 2004 Update. World Health Organization, Geneva 2008. www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_full.pdf (Accessed on May 02, 2024).

You, K; Yang, HT; Kym, D; Yoon, J; Haejun, Y; Cho, YS; Hur, J; Chun, W; Kim, JH. (2014). Inhalation Injury in Burn Patients: Establishing the Link between Diagnosis and Prognosis. *Burns*. 40:1470–1475.