

Burns and Scalds – Epidemiology and Prevention in a Developing Country

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ABSTRACT

Background: Burns and scalds are common presentation to many of our health institutions. Most of these injuries are preventable. Many of the patients however end with severe morbidity or even death. People affected are mostly of poor socioeconomic status. The cost of managing these injuries is high. Coupled with this are poor facilities in most parts of the developing countries like Nigeria and insufficient personnel to take care of this group of people. Study of the epidemiology as well as suggestions on preventive measures are therefore overdue and hence this publication.

Methods: A review of the literature on this subject with emphasis on Nigeria was done bearing in mind the epidemiology and prevention of burn. Literature search was done using the medline as well as local journals.

Results: Causes of burn injuries are many in the developing countries. Most of these are however preventable. Some preventive measures have been suggested by workers in this part of the world. Some measures that have worked in reducing burn injuries in some advanced countries and that may be appropriate to our situation are noted and are also suggested in this paper.

Conclusion: Prevention of burn injuries, based on the epidemiology of burn in developing countries, remains a major way of reducing the current spate of morbidity and mortality in our patients.

KEY WORDS: Burns; Scalds; Fire disaster; Epidemiology; prevention; Nigeria.

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INTRODUCTION

Burn injuries are universal and have plagued mankind from antiquity to the present day¹. These may be by fire, hot liquids and contact with hot surfaces or chemicals. In many

tropical countries, the low level of socioeconomic development is a major cause of burn injuries².

The mortality from burn injuries is decreasing in economically developed countries due to implementation of effective burn prevention programs and regulations as well as improved burn treatment. This decrease has been experienced by countries like United Kingdom and United State, sadly, after major disasters before remedial action was initiated. In the United States, it followed Boston Coconut Grove nightclub fire³, which killed 491 people. This led to remarkable advances in burn treatment and stimulated organization of burn care facilities, public safety regulations and prevention.

In the UK, Bradford stadium disaster of 1985²³ resulted in 55 persons killed and 283 hospitalized. Stricter regulations in construction and maintenance of sports stadia were enacted thereafter.

Between 1971 and 1991 in the US, the rates of decline in deaths attributed to fire and burns with acute hospitalization for burn injury were about 50% taking into account the 25% increase in the size of US population⁴. This improvement coincided with advances in burn treatment and the promulgation of prevention programs⁵. During this period, regional burn treatment centres were established in virtually every major population centre; smoke detector use became widespread, and fire and burn prevention education was expanded substantially.

The lack of facilities, shortage of antimicrobial agents and dressings, and scarcity of medical personnel trained for burn rehabilitation are problems faced by the majority of burn patients in Africa⁶⁻⁸.

Fire is a very destructive agent. The low socio-economic level of most inhabitants of the developing countries, like Nigeria, make burn injury a devastating disaster not only to the

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patients who live on meagre incomes but also overburdened dependants. Where such a man is a breadwinner, the entire family members suffer. "The personal tragedies involved in serious burning accidents need no elaboration. The cost to the community is high, involving in England and Wales some 60,000 patient-week of acute hospital care; the cost to the individual patient is often overwhelming. No scale of values can measure the immense suffering endured by patients with extensive burns: prolonged periods during which painful dressings have to be done every second day, blood transfusion accepted, hundreds of litres of high protein feeds swallowed, and extensive surgical procedures undertaken; and often at the end of the illness the prospect of further long programs of Plastic Surgery to minimize the disability and disfigurement"⁹.

The financial burden of these procedures to the patients as well as our limited hospital resources is enormous. More so when helpful programs like the health insurance scheme is yet to take effect in most developing countries.

This is the reason for which preventive measures, through which significant reduction in both the incidence as well as mortality in richer and more technologically advanced nations has been noted, need not only be sought but also aggressively implemented.

Many authors have suggested ways of preventing burn injuries in Nigeria as well as other nations of the world^{1, 7, 8, 10-16}. Our aim is therefore to highlight some of these burn preventive programs bearing in mind the epidemiology of burn in Nigeria. We believe the knowledge of these burn preventive programs will go a long way in reducing both burn incidence and accompanying morbidity as well as mortality.

Burn Disasters in Nigeria

Recent events in Nigeria, more than ever, call for the need to prevent burn. In 1998, over 1000 lives were lost at Jesse, Delta state when a pipeline conveying petroleum products was vandalized and exploded¹⁰⁻¹². Several villages and farmlands were destroyed. Many of the villagers were severely burned and many more had serious morbidity. Since then, there have been several incidents with hundreds of lives lost in various parts of the country.

Kerosene explosion occurs almost every week in one part of the country or another. Grange *et al*¹³ reported flame burn disasters from kerosene appliance explosions in Lagos in 1988. There have been other unpublished kerosene burn explosions in Nigeria (Gwagwalada in 2000, and Edo state in 2001) while several people lost their lives in Lagos in 2001¹⁴.

Several people have lost their lives in one fire incident or the other, usually during periods of petrol scarcity¹⁵. A fire incident occurred at the Nnamdi Azikiwe University medical students' hostel in Anambra State (unpublished) where a gas exploded and 9 (8 females and 1 male) students were burned in May 2001. These students were managed in our burns unit. Six of them died.

In November 2001, a pipeline explosion occurred at Owerri, Imo State, killing 15 people with many others injured. Our burn care team was also involved in managing these patients. These were in addition to several burn cases that occur in homes, factories as well as roads from road traffic accidents and several communal clashes in many parts of the country leading to loss of lives and properties. It is therefore obvious that no part of the country is immune from these disasters.

Sowemino¹ notes that burn ranks amongst the most severe type of injuries suffered by the human body and are attended by high mortality and morbidity rates. He opines that since the epidemiology of burn tends to vary with men, continued modifications engage the attention of surgeons so that rational preventive measures can be devised to suit each situation and burn management techniques improved.

Linares and Linares⁸ submit that for an approach to burn prevention most likely to be effective in a particular area, it should be based on sound knowledge of the prevalent aetiological patterns of burn injury and socio-economic differences in burn epidemiology.

Epidemiology of Burn

Flame constitutes a major source of burn in Nigeria. This is similar to what obtains in both developing as well as developed words (Table I)^{1, 15-20}. Sowemimo¹ notes that flame burn resulted from a large number of miscellaneous causes in both children and

adults among his series. Fasika¹⁵ also reports that fire, often petrol flame was the commonest cause of burn in his study over a 4- year period in Ibadan and notes escalation of cases with fuel scarcity. Moist heat came second in Fasika's series with 16%, while chemicals and electricity were the causes in 5% and 2% respectively.

Datubo-Brown and Kejeh¹⁶ note that scalds constituted the largest aetiological factor (45 of 102 cases) closely followed by flame.

Our recent review (unpublished) of the epidemiology of burns in all age groups in our centre shows flame as the commonest agent (49.1%) with scalds following (37.9. %) while chemical and electrical burn were 7% and 1.4% respectively.

Among the paediatric patients, Mabogunje *et al* report that 254 of the 429 patients sustained flame burn while 175 suffered scald burns. Iregbulem and Nnabuko²¹ showed that hot liquids were the predominant aetiological agents being responsible for burn injuries in 527 (81.8%) of our paediatric patients at the National Orthopaedic Hospital, Enugu while 11 children (1.0%) had contact burn (Table II). Seasonal variation in number of patients burned has also been observed²⁰⁻²⁷.

In another West African country, Marktelow¹⁷ reports similar aetiology of burn; that all his burn patients in Liberia were either from scalds or flame while Hag¹⁸ reports that burn was the third commonest cause of surgical admission in a Kenyan (East Africa) provincial hospital with open fire constituting the largest (69.3%) while scald was 19.2% with chemical and electrical burn constituting 4.1% and 7.4% respectively.

Gupta *et al*²⁷ show that 62 of the children in Jaipur, India, suffered flame burn with only 5 suffering from electrical burn. Most workers have reported male predominance in burn injuries^{1, 15-19}.

Sowemino reports that industrial burn accidents, which were mostly flame burns, were most common in young working adults in the 20-30 year age group and that males predominate. Fasika noted that burn was sustained in 30% of his reported cases in the street and 4% at home.

Hag reports that industrial, electrical and corrosive burns are largely occupational hazards injuries while Marktelow's¹⁷ series in

Liberia shows scalds or flame, reflecting the lifestyle of Liberians who cook at ground levels. This lifestyle is not different from what obtains in Nigeria as reported by Mabogunje. The children were particularly vulnerable and accounted for approximately 70% of all victims in the Liberia¹⁷ series. Over 90% of the paediatric burns occurred at home, particularly in the kitchen^{27,28}. Traditional treatment by hot fomentation especially in children who have febrile or any form of convulsion is also not uncommon. Young children, the elderly and individuals who are differently abled are at highest risk for residential fire deaths²⁹.

Mortality from burn is still high in developing countries²⁹⁻³¹. Various authors have reported high mortality in their series from various parts of Nigeria. Sowemimo¹ reported 13.6%, Fasika¹⁵ 35.4%, Mabogunje's²⁰ overall mortality was 13% among children. Iregbulem and Nnabuko also had a mortality of 9.8% among children, which compares to rates of 7.69% in USA²¹.

Datubo-Brown and Kejeh¹⁶ report a mortality of 26.9% in Port- Harcourt. Our recent review reveals a mortality of 23.2% in both adults and children while Gupta *et al*²⁷ reported 19.7% mortality in Jaipur, India.

It has been difficult to obtain statistics concerning how many people have died from disasters like flame burn resulting from pipeline vandalization and petroleum products leakage as noted earlier⁹⁻¹¹. Various hospital-based reports however show that flame burn occurs most of the times in the home as a result of explosion of kerosene lantern, stove or gas cookers¹⁶⁻²⁰. This has been attributed to adulterated petroleum products in the recent times as well as illegal storage of petroleum products in the home in Nigeria, especially during episodes of acute scarcity¹¹. Flame burn may also result from cigarette smoking when smokers sleep off while smoking or from lit candle, which may ignite furniture.

Scald burn from hot water, soups, oils, were the predominant aetiological agents responsible for burn injuries in 527 patients in Iregbulem and Nnabuko series among children²¹. These resulted from spillage as a result of cooking done at floor levels.

Mabogunje *et al*²⁰ reported that in Zaria, within the Nigeria Savannah, factors which contribute to burn accidents include

living in thatch-roofed huts, farming and hunting methods which include bush burning, cooking with firewood at ground level, the traditional puerperal rituals of hot baths and mud beds heated by wood fire, the necessity for making fires to warm the dwelling and the body during the dry and cool harmattan seasons and loose indigenous garments.

Prevention

Risk factors for injury include poverty, poor housing and poor education. Prevention therefore requires individuals, local communities and governments to work together³². The development of strategies for burn prevention needs to consider active and passive approaches³³. Active actions imply changes in individual lifestyles and include health education for injury prevention and family planning. Passive actions seem to have more acceptance because of the possible results in a short period^{34, 35}.

The home has been shown to be the site of most burn injuries in most papers reviewed. The traditional use of kerosene stoves for cooking in some areas is condemned to be responsible for most household flame and scald burn among the female population in Egypt²⁵.

Prevention of burn must therefore commence from the homes. Sowemino¹ submits that health education aimed at the prevention of burns in homes as well as in industries is of the greatest importance in our fight against the devastating trauma of burn injuries. He suggests that cooking at ground levels, which is traditional in most parts of Nigeria within the reach of toddlers who are adventurous and unaware of the dangers of burning, should be avoided. Modern gas and electric cookers where cooking is done at heights of about 1metre are safer and their increased use will result in fewer burn to young children in the kitchen having recognized that young children, the elderly, and individuals who are differently abled are at highest risk for residential fire deaths.

Markelow¹⁷ notes that supervision of the children is often delegated either to grandmother who is too old or infirm to be an adequate caretaker, or to an older child who may not understand the dangers. He opines that if one could educate the parents to avoid

the practice and provide an adequate level of care for their children, the number of burns, or at least the severity, might be reduced. He also advises on establishment of childcare facilities where children are well taken care of like the nursery facilities.

Untreated epilepsy has also been noticed to account for a significant number of burn¹⁷. This is because epileptic patients who are either not on any medication or on medications that sedate are often left to cook for themselves. They either have epileptic attacks and fall into the fire or fall into the fire as a result of sedating effects of their medications. Education, with advice on the need to have a long-term medical care treatment and follow up, will alleviate this problem in this group of patients.

Iregbulem and Nnabuko²¹ noted that thermal burns in children are a common cause of morbidity and mortality in Nigeria and that socio-economic conditions play a significant role in their aetogenesis. Any worthwhile reduction in the incidence of such injuries will only come about through sustained government sponsored massive public education campaigns and improved socio-economic status of the citizenry.

The four routes through which burn can be prevented are^{22, 32}

- i. Education
- ii. Publicity
- iii. By making home, work, or leisure safer
- iv. By legally banning dangerous activities, equipments.

Education

Burn prevention through education programs are being used widely all over the world³⁵⁻⁴¹. Dietrich likened education to active immunity, in that both are relatively slow to afford protection but are life-long if boosters are received⁴². Keswani⁴³ found that after nine years of continuous school education there was a decrease in mortality rates at Bombay, compared to the neighbouring population of Pune that had not received such an education. Education of the public in native language on radio and television will help reduce fire hazards²⁰.

As has been established, most burn patients come from the poorest and often

illiterate levels of the society. Parents as well as mothers who cook on the floor or refill lit kerosene stove or lantern must be included. It must also include men and women who store petroleum products in the house and those who vandalize pipeline or those who farm close to pipelines. These people should be the target of the education programs, which may include talks or lectures to people at risk or more subtle approaches by posters advertising like;

1. "Don't refill a lit lantern".
2. "Do not cook on the floor".
3. "Keep away petrol from your home".

This must be done when people being educated are at receptive mood²² e.g. pregnant women at antenatal care, or at post natal care; social and religious gatherings.

Education of children may also be in junior schools for children under 12 years or clubs in the tertiary institutions. Burn prevention Brigades may also be established especially in special areas prone to vandalization of pipelines. They then spread the message of burn prevention to homes, villages, markets, churches, mosques as well as social clubs and gatherings.

Publicity

This has been found to be effective but effect tends to be short lived. Mabogunje *et al*²⁰ reported that their state ministry of information and social welfare produced in Hausa, the vernacular language, a television programs on fire hazards. This is shown several times on the local television station during the dry season and may be seen at public viewing stations. This method is particularly advantageous because most of the target population is illiterate. Programs like these can be aired during social activities and public holidays when most adults are relaxed at home. Cooperation must be given by the press with personal relations built up with the local press in helping with stories.

Prevention by making the Home, Work or Leisure Safer

Mabogunje *et al*²⁰ again suggested improvement in the economic status of the population as this would lead to the creation of home environment in which deficiencies in parental supervision or excesses of childhood exuberance do not result in serious accidents.

Provision of jobs by governments as well as various private establishments will also reduce the chance of the unemployed youths vandalizing pipelines.

Architectural improvement in the design of home would separate the kitchen from the sleeping areas so that the former could be shielded for the safety of children. Puerperal rituals which predispose to burn, both of mothers and children, could have a safer method designed to warm the parturient²⁰. Also important is a large-scale conversion from cooking with fire woods to cooking with gas, with appropriately designed elevated cookers and utensils which would be more difficult to spill or overturn and a safer method of heating the home during the cold season. Regular supply of electricity will also reduce the need to use kerosene lanterns and stoves. Making unadulterated fuel available is likely to discourage the need to store fuel in the house. Fire extinguishers, fire alarms and smoke detectors in homes and offices, training of members of public on its uses are also of a great help.

Work can be made safer by investigating accidents and if necessary legal penalties from an outside safety organization who have the ability to close down a dangerous process or factory if on inspection it is found to be neglecting legal restraints. Suing for damages by injured workers is also effective in making industry more careful and a reward scheme for "injury free days" is also highly effective.

With leisure, it is good to identify remediable problems. Masquerades should not move close to a source of fire. Other sources of recreation must be made safe. This will lead to reduction in flame as well as other forms of burns.

Changes in the Law

Legislation can help by ensuring the maintenance of proven prevention strategies⁴⁴, but too much takes the spine out of a people⁴³. Legislation includes legally banning dangerous activities like storing petrol in the house or in containers inside a vehicle thereby preventing fire disasters that may occur in case such vehicles are involved even in minor road traffic accidents.

While it has been noted that even in the advanced world it appears that disaster is often necessary to provoke a political response; as in major alteration in the design of places of public entertainment that accompanied the coconut fire disaster in Boston, U.S.A; political response in the developing countries like Nigeria appears to be non-existent or at best

very low, hence the constant recurrence of these disasters.

The law should be enforced on anybody who deliberately pours chemical on another. Any one caught vandalizing petroleum pipelines should be prosecuted and appropriately penalized.

Table I. Aetiological Agents in Burn (in %) in Nigeria, Kenya, Liberia and USA

Agents	Sowemimo (Nigeria)	Datubo- Brown and Kejeh (Nigeria)	Fasika (Nigeria)	Marktelow (Liberia)	Hag (Kenya)	USA
Flame	56.2	47.8	77	34.6	69.3	82
Scald	42.7	48.9	16	7.7	19.2	12.4
Chemical	1.1	2.2	5	3.8	4.1	1.8
Electrical	--	1.1	2	--	7.4	3.0
Grease	--	--	--	53.9	--	--
Total	(100)	100	100	100	100	100

Table II. Paediatric Burn in Nigeria and India

Aetiological agent	Iregbulem and Nnabuko (Nigeria)	Mabogunje <i>et al</i> (Nigeria)	Gupta <i>et al</i> India
Flame	14.7	59.2	41.7
Scald	81.8	40.8	53.9
Chemical	0.5	-----	-----
Electrical	0.6	-----	-----
Contact	1.7	-----	-----
Explosion	0.6	-----	54.4
Total	100 %	100%	100

CONCLUSION

Burns and scalds are severe injuries. The low socio-economic state of most people in the developing countries like Nigeria, with poor housing, contribute in no small measures to both the incidence as well as the significant morbidity and mortality that accompany these injuries. The effect on the victims and the family members is worse than in advanced countries since the patient with his family bears the financial burden.

Epidemiological studies should be encouraged regularly for appropriate prevention program, which should be at various levels.

Individuals must be burn conscious, taking precautions to avoid burn injuries both to himself and others who live around him.

Families must plan both the building as well as arrangement of materials and equipment's in the house. Children must not be allowed to handle cooking where they are not matured enough to be conscious of implications of handling flammable objects carelessly and must be taught on burn prevention by older family members.

Governments must make the environment safe and improve the purchasing power of the citizens, making amenities like light and unadulterated fuel available as well as enacting and enforcing laws that will be geared towards burn prevention.

Establishing Burn Associations to carry out prevention campaigns will also help. Fasika¹⁵ suggests that an improved funding of burn care coupled with establishment of burn

units in at least five regions of the country is urgently indicated.

We suggest Burn centres should be established in each of the six geo-political zones while every Teaching and General Hospital as well as the Federal Medical Centres should have at least a small burn unit where patients can be managed instead of admitting them into same wards with other patients with infected wounds which also predispose them to resistant bacteria. Training of medical and ancillary workers in the care of burns will also produce an improved care. The scandalous perennial shortage of petroleum products has created a lucrative economy for illegal bunkers in civilian and military circles. Unless the systematic distortion is eliminated, fuel related tragedy would not cease⁴⁵. Thus to prevent burn injuries, reduce burn care expenses, and relieve the social burden from long term disability, programs that alleviate poverty, overcrowding, family stress and educational deficits and that target high risk people living in these conditions are requisites complements to programs that promote burn prevention directly³⁵. In conclusion, Chinese philosopher Kuan Tzu says “if you plan for one year, sow rice, if you plan for ten years, plant trees, if you plan for a hundred years, educate people”⁴⁶.

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