

**CHILDHOOD THERMAL INJURIES**

**CHILDHOOD THERMAL INJURIES AT KENYATTA NATIONAL HOSPITAL:  
A SOCIO-ECONOMIC AND AETIOLOGICAL STUDY OVER A TWO YEAR  
PERIOD. SEPTEMBER 1977 TO SEPTEMBER 1979.**

---

**JACOB SITEFANO MALECHE MBChB(NRB)**

A thesis submitted in part fulfilment for the  
degree of

**MASTER OF MEDICINE (SURGERY)**

**In the University of Nairobi, Kenya**

**1980**

University of NAIROBI Library



0324766 5

**MEDICAL LIBRARY**

**UNIVERSITY OF NAIROBI**

**DECLARATION****CANDIDATE**

This thesis is my own original work and has not been presented for a degree in an other University.

**J. SITEFANO MALECHE**

**SUPERVISOR**

This thesis has been submitted for examination with my approval as University Supervisor.

**MR. M.M. MBALU**  
**SENIOR LECTURER DEPARTMENT OF SURGERY**



## CONTENTS

### Summary

<u>Chapter</u>	<u>Page</u>
i. Introduction	3
ii. Methods	13
iii. Results	15
iv. Discussion	56
v. Conclusion and Prevention of burns	63

### Appendices

A. Definitions	67
B. Acknowledgement	68
C. References	69

Guide to Tables

<u>Tables</u>	<u>Page</u>
i. Racial Origin of Parents .....	17
ii. Occupational Status of Parents .....	20
iii. Marital status of Parents .....	23
iv. Occupation of mothers .....	26
v. Number of children in Family .....	29
vi. Previous accidents of burnt children.	31
vii. Age distribution of patients .....	34
viii. Sex distribution of Parents .....	36
ix. Responsible Adult at the time of injury .....	39
x. Place where accident occurred .....	42
xi. Scalding agent, depth of scalds .....	45
xii. Burns Ignition agent .....	52
xiii. Severity of accidents .....	55

**S U M M A R Y**

**CHILDHOOD THERMAL INJURIES**

**THE DISEASE AS SEEN AT THE KENYATTA NATIONAL HOSPITAL  
OVER A TWO YEAR PERIOD SEPT. 1977 TO SEPT. 1979**

(I) This study was conducted to determine the incidence of thermal injuries in children admitted to the Kenyatta National Hospital during the period September 1977 to September 1979.

(II) The study was carried out in the Department of Paediatrics, Kenyatta National Hospital.

(III) The study was carried out over a two year period from September 1977 to September 1979.

The study was carried out in the Department of Paediatrics, Kenyatta National Hospital. The study was carried out over a two year period from September 1977 to September 1979. The study was carried out in the Department of Paediatrics, Kenyatta National Hospital. The study was carried out over a two year period from September 1977 to September 1979.

Burns (Thermal) injury is a common cause of admission to the hospital. All age groups are affected. Majority of thermal injuries do occur in children below fifteen years of age. The symptoms of thermal injuries are obvious. The physical signs and diagnosis are made by seeing the patient. There is little confusion between burns injuries and other diseases.

Thermal injuries are taken for granted by all those who manage these patients. The patients are usually admitted, treated and discharged home and no more is thought about the root cause of this disease. Few people realise the long term effects of thermal injuries to those affected. In our set up we rarely follow up those patients to be able to evaluate their disabilities arising from the burn's injuries. With this in mind I therefore undertook this study to prove:

- (i) that for every child admitted to hospital with a thermal injury, there may be social factors behind his accident.
- (ii) that economic factors are involved in the causation of burns injuries.
- (iii) that thermal injuries are largely preventable.

In my two year prospective study I analysed various social circumstances that surround these patients. I also analysed the causative factors of these accidents in detail. The study was carried on two hundred and eighty-four children admitted to the Burns Unit at Kenyatta National Hospital. All the patients analysed were between one year and fifteen years of age.

60.2% of the patients were males and 39.8% were females. 96% of all the patients reported to hospital within twenty-four hours from the time of injury. The remaining four per cent were delayed, because of difficulty in transport, or because they went to another hospital or health unit but later were transferred to Kenyatta National Hospital. The study has shown the various causes of burns and has revealed that certain age groups of children have a higher risk than the rest of the population. The study has highlighted the areas in the house and in the community where thermal injuries are likely to occur. It is shown that males tend to be more prone to injury as compared to the females, the ratio of 2 : 1. Toddlers are likely to get scalds in the kitchen or dining hall, while the other age groups receive flame burns outside the house. Thermal injuries are more common in the large and congested family units. The study has also shown clearly that most children receive burns at the time when there is no responsible adult present. This is relevant to our society because most children are left at home under the care of other children. The nature of work of the mother does influence the incidence of thermal injuries. 68.6% of all the mothers whose children were burnt were full-time employed. The study has revealed clearly that thermal injuries are very prevalent in low income earners and the unemployed. 70% of all the children burnt came from this group.

Thermal injuries are a public risk, there is a need for a National prevention programme for thermal injuries. Education of the whole population and legislation to protect fire heaters and other places would be a big step in reducing the mortality and morbidity of this disease.

STATEMENT OF THE PROJECT STUDY

CHAPTER I  
INTRODUCTION

There is a general realization in the world that the progress of industry is dependent on the quality of the man-power which is available to it. The development of a nation is largely dependent on the quality of its human resources. The growth of industry is not possible without the development of a high quality man-power. The development of a high quality man-power is a complex process which requires a long and arduous effort. It is a process which involves the development of the physical, mental, and moral qualities of the individual. It is a process which requires the cooperation of the individual, the family, and the society. It is a process which requires the support of the government and the community. It is a process which requires the investment of time, money, and effort. The development of a high quality man-power is a process which is essential for the progress of industry and the growth of a nation.

This study is an attempt to investigate the factors which influence the development of a high quality man-power. It is a study which is intended to provide a basis for the development of a high quality man-power. It is a study which is intended to provide a basis for the development of a high quality man-power.



### PURPOSE OF THE PRESENT STUDY

Accidental injury is probably the most common cause of illness between the ages of one year and fifteen years. However in most developing countries, like ours this may not be wholly true. Infectious disease, malnutrition and its associated complications seems to be the commonest cause for illness of most of the children. At Kenyatta National Hospital total yearly admission of children is about 6,500. Of this over 6,000 is due to infection and malnutrition (Kenyatta National Hospital Records Department).

There is a general realization of the fact that the problem of children is due to infection and poor feeding and positive steps to combat this have been taken. There is a well established National Maternal Child Health/Family planning programme to deal with this problem. Thermal injury is not yet a recognised disease in the mind of most people including the medical workers. As I worked in various up country hospitals I was surprised by the way burns are managed. Usually the patients are dumped in a general surgical ward. The management is haphazard. No attempt is made to think of the cause of the burns and nobody thinks of the possible sequelae. No reappointments are made for this patient to be assessed again at a later date. As a result there are many people in this country, with ugly scars, and with disabling and incapacitating contractures.

When I started my post-graduate studies it was fortunate my first rotation was in plastic unit for

which "Burns Unit" forms an important unit. As I worked in the unit I decided to look deeply into the social and causative factors surrounding burnt children. My aim in carrying out this study is to show that:

- (i) thermal (Burns) injury is an increasing common disease of the children and that its time for everybody to realise the importance of this disease.
- (ii) that the social and causative factors of this disease are largely known.
- (iii) that this disease is largely preventable and that there is a need for formation of National Thermal Preventing programme in order to reduce the mortality and morbidity of this disease.

There are attempts in this country to improve the management of thermal injuries. At Kenyatta National Hospital plastic surgery is now recognised as a discipline of its own. It is headed by a Senior Lecturer on the University side and a Government Plastic Surgeon. A "Burns Unit" has now been established and it is fully functional. The unit is the only one of its type and was set up in 1975. It is headed by a Senior Plastic Surgeon, a Surgical Registrar and a Nursing Sister in Charge. In all other parts of the country burns cases are usually managed and admitted to general surgical wards. They are managed by doctors other than plastic surgeons. This unit has all the facilities including a theatre for the management of burns. It caters for all adults including children suffering from burns of sufficient severity to warrant admission. The unit is

also a referral centre for the rest of the country. During the past three years the unit has admitted an annual average of one hundred children. These are burns of enough severity to warrant admission. This is about 0.4% of the total number of children admitted yearly at Kenyatta National Hospital.

The above figures give the impression that childhood burns is a problem of little magnitude at this hospital. However, it must be realized that this incidence takes into account only that total number of children whose burns are serious enough to warrant admission. There are no figures for the number of burns that are managed on outpatient basis. Furthermore there is a self-selection of patients admitted to Kenyatta Hospital. Majority of patients come from the low income and unemployed groups. Many of the high income and rich groups have their children admitted to private hospitals. Therefore these figures are not a true representation of childhood thermal injuries as seen at Kenyatta National Hospital.

The magnitude of this problem and its significance derives from the fact that it is associated with burning and obvious likely sequelae. Mortality is high in those children who receive over ten per cent deep burns. The overall mortality in my study was six per cent. In centres where there are no proper facilities mortality may be as high as 15 - 20%. Those who have deep burns will need skin grafting to hide their ugly scars. About an eighth of all those burns will develop contractures that need highly sophisticated plastic operations to correct. More often the correction is never perfect. Those receiving thermal injuries carry the scars of the incidence for life. It is this that makes this disease unique.

## A REVIEW OF THE LITERATURE

Burn's injury is now being recognised as probably the commonest childhood disease. In response to this a journal for the International Society of Burns was formed in 1974. The need for international co-operation in the management of burns has now been fully recognised. This society works in close association with World Health Organisation in matters regarding burns injuries. Leokaprio (1978) at the 5th International Congress of Burns emphasized the need for recognition of Burns injury syndrome. The creation of a Burns Unit or Centre in every country has been over- emphasized (References 1, 3, 8, 12, 14, 27, 32, 42, 56).

The aetiological factors involved in burn injuries are the same all over the world. There is a difference of agents involved due to different stages of sophistication and civilisation of the various countries. For example there are more electrical injuries in developed countries as compared to the developing countries. Scalds are common and in children are caused by common fluids found in the kitchen, Tea or Coffee fluids being the commonest. In my studies, porridge features prominently. R. Bovayad Agha (1978) in Algiers showed that scalds are the commonest burn injuries. From the literature many authors agree with these findings (References 2, 3, 4, 8, 11, 13, 15, 20, 24, 26, 28, 29, 42, 47, 56). Majority of scalds occur in the home environment and generally associated with children. In developed countries scalds also occur in the factories and industries. These usually involve adults who are employed.

Fire is closely associated with burns. Flame burns are common in bigger children and adults. In adults they occur as industrial hazards and therefore are common in industrialised countries. In poor countries flame burns are very closely associated with events in the house. Most families use fire for cooking. The burns are therefore found in the childhood group. They occur both indoors and outdoors. Indoors, they are associated with cooking agents. A charcoal burner is a common domestic cooking agent involved with flame burns. Domestic heaters and electrical instruments are two commonly involved other instruments.

The incidence of burns injuries varies greatly in various countries. The problem is that many countries, have no epidemiological studies of burns. These are countries in which burns are not yet fully recognised as a disease entity and there are no specialised centres for Burns at all. However it is shown in various references that burns is a common disease of childhood in many countries. In highly developed countries it is the commonest ailment that bring the children to hospital (T. Nagasaki, Burns Vol. 5 1978). In developing countries the incidence of burns is much lower compared to malnutrition and infectious diseases. In my study burns formed less than 2% of all the total childhood admissions to hospital (Kenyatta National Hospital Records Department). Kaokab Karim (1974) in his study has shown that incidence of burns is very much related to overcrowding, poor housing and lack of proper medical facilities and ignorance.

Burns are strongly associated with the socio-economic factors in the society. The incidence of burns

is higher in the poor communities. In a speech by Leokaprio (1978) to the 5th International Congress on Burn injuries, the association of socio-economic factors with Burns was well outlined. There are many families that stay in single roomed houses. In such situations the incidence of burns has been directly related to the size of the family; the more the number of children, the higher the number of burns. In poor families the parents spend most of their time working elsewhere to earn a living, usually leaving the children to themselves or to another child to look after them. The lack of a responsible adult to look after children has been clearly associated with high incidence of burns. Disturbed marital status is now a recognised factor in the causation of burns. The battered baby syndrome is a well known entity (References 3, 6, 7, 8, 11, 15, 24, 26, 28, 29, 39, 40, 43, 47, 48, 61).

Certain groups of people are prone to burns because of predisposing conditions. These are drunkards, epileptics, smokers and leprosy patients. Bhatnagar (46) in 1976 showed clearly in his study that burn injury was a complication of epilepsy. He concluded that treatment of the primary condition was the only cure. These groups of patients are usually socially forgotten, usually living a living alone in extremely poor conditions.

Burns may occur at all ages. The two peaks of burns in life occur during childhood and the very old age. The toddlers have the highest incidence of burns. This may be due to lack of parental care for those who

come from poor social backgrounds. However toddlers are fascinated with the presence of objects and are unintelligent. (References; 2, 3, 5, 8, 10, 11, 15, 24, 26, 28, 61).

Burn injuries are among some of the most unpleasant accidents that do occur. They are associated with horrifying experience to the patient. Majority of patients receive burns when they are fully conscious and can witness the accident. Patients experience intolerable pain, no wonder pain relief is a most important first aid management. Patients continue to experience pain throughout the course of their disease. The burnt patients have invariably a prolonged stay in the hospital. Those with extensive burns remain under the care of the doctors throughout their life time. Flora (1972) found that the length of stay of patients depended on many factors. He concluded that the length of stay of these patients was longer than for other diseases. Following a burn a patient remains with a permanent scar; this has many implications to the future of the person involved. For ladies it may mean a whole future lost. Patients have committed suicide later after successful treatment in burns centre. A small percentage of patients develop severe disabling complications. Loss of function of a limb is a serious complication needing change of profession and proper rehabilitation. Formation of keloids is a common complication especially in the black patients. Massive frontal keloids are impossible to manage. A burns scar is a known premalignant condition and the development of marjolin's ulcer (squamous cell carcinoma) is well documented. Amputation is necessary in severe burns of the limbs.

Burns injury is a total disabling disease. Many patients who receive burns remain with a permanent reminder of the disease in their lifetime. Rehabilitation of these patients is necessary. In some cases rehabilitation needs to be extended to the whole family of the patient. Leeder (1978) believes that families of burns victims should receive help through regular group meetings. Papp (1978) stressed the need for health education of inpatients and the need for psychiatric help to these patients. All burns centres should be attached to a rehabilitation centre, and rehabilitation personnel should be part of the management team of a Burns Unit. (References 3, 9, 10, 13, 16, 17, 18, 19, 21, 22, 23, 38, 44, 49, 50, 52, 54, 56, 58, 60, 67, 68).

It is now accepted that the best treatment for burns is prevention. McLoughlin (1979) in his study entitled "Burns Education" stressed the importance of health education and outlined various measures to help reduce the incidences of burns. From the socio-economic and aetiological studies it has been shown that factors associated with causative agents of burns are all preventable. We have seen that burns are common among the poor people who are illiterate, live in poor housing, with chronic congestion. In my study I have shown that children left without parents have a higher incidence of burns. I have shown that there is a higher incidence of burns in families which are unstable. Most studies have shown that scalds generally occur indoors and that the factors involved are preventable. Keswan (1974) devoted his study on how to prevent burns. He outlined simple rules that would reduce the incidence of burns that occur indoors. (References; 1, 3, 4, 5, 6, 7, 15,



20, 24, 42, 55).

In the developed countries prevention of burns is a state policy which is governed by a legislation act. The law governs all fire places and all electric heaters. All fire places must be guarded and made out of reach to the toddlers. All fire heaters must have protective bars so that direct contact with the hot metal is not possible. In Australia (T.P. Joseph (1979) et al) since the introduction of this legislation there has been a reduction in the number of burns caused by electric heaters. In this country there is a legislation under "Public Health Act" governing fire places. However it appears the law is not being enforced. In order for legislation to be effective it must be supported by the state and enforced through the state machinery (References 1, 3, 4, 5, 18, 20, 24, 42, 48, 55, 56, 61).

The Burns prevention programme must be well planned in order that people at all levels of the society are reached. Now most countries are beginning to include "child safety" in the school curriculum. The children are taught about the hazards of fire and scalds. This section is made compulsory teaching and children are examined in the subject. It is hoped that when the children become parents they will be able to put their knowledge into practice and reduce the incidence of burn injuries during their generation. The use of audio-visual aids, films and mobile travelling teams in the remote areas of the country is effective. The people in the remote areas are also illiterate groups and can only be reached by teams that go down to the villages where they stay. They must be taught in their own

vernacular language, and great care be taken not to force them but cleverly convince them to accept the new knowledge. It is also necessary that people in important public places such as doctors, nurses and teachers should be reached first. Such people should be included in the programme. T.P. Joseph (1979) et al has proposed a prevention programme for South Australia State for reduction of burns injuries. Good transport facilities are necessary for the success of such programmes. In this country such a programme would need to learn a lot from and probably be initially associated to Maternal and Child Health Programme which is a well established and successful organisation.

The paper was submitted to the Journal of the American Psychological Association and published in the November, 1977 issue. The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada.

## CHAPTER TWO

The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada.

## METHODS

The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada.

The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada. The study was conducted in the city of Toronto, Ontario, Canada.

The Burns Unit at Kenyatta National Hospital admits children and adults from all over the country. It is a referral centre for the country and also the only Government Burns Centre in the City of Nairobi. This has been a prospective study for all children admitted to this unit from 1st September 1977 to 30th September 1979. The study is confined to children aged one day old to fifteen years of age. The unit admits only those cases that are serious enough to need admission. Most of the times a number of cases that are seriously burnt do not get admitted because of the inavailability of beds in the unit. Such cases are treated in the Casualty Observation Ward, sometimes until they get better and are discharged home. The Casualty Observation Ward has indeed become a burns unit centre out of sheer necessity. All the patients in my study were from the Burns Unit proper.

For every child admitted to the unit a detailed inquiry into the social circumstances surrounding the child was made. The actual causative agent of the burnt was asked for. In order to do this a proforma was designed. The proforma contained all the necessary questions to enable me to know the social circumstances of the child and family and the actual aetiological factors involved. The forms were completed at the time of admission and rechecked at the time of discharge. The forms were completed by me or by the nurse on duty on that day of admission and on the day of discharge.

The study was restricted to those admitted only, as I found it difficult to have a good follow up of the out patient burnt children. The out patient burnt children are irregular in their clinic attendances.

It is also difficult to find reliable information about the children and their families. Usually the child is brought to the clinic or hospital by a maid or a relative who is not willing to answer all your questions. Majority of the out patient children attend burns clinic only for a short time and decide to go to other hospitals at their own discretion.

In this two year period a total of 284 children below the age of fifteen years were admitted and treated in this unit. They were all of African origin. 60.2% were males and 39.8% were females. The information gathered from the analysis of this proforma collected on 284 cases admitted during the period from September 1977 to September 1979 forms the subject of this study.

The present study was designed to determine the effect of the amount of water on the growth of the plant. The results of the study are given in the following table. The results show that the amount of water has a significant effect on the growth of the plant. The amount of water that is given to the plant is a very important factor in determining the growth of the plant.

**CHAPTER 3**

The purpose of this study was to determine the effect of the amount of water on the growth of the plant. The results of the study are given in the following table. The results show that the amount of water has a significant effect on the growth of the plant. The amount of water that is given to the plant is a very important factor in determining the growth of the plant.

**RESULTS**

The results of the study are given in the following table. The results show that the amount of water has a significant effect on the growth of the plant. The amount of water that is given to the plant is a very important factor in determining the growth of the plant.

The amount of water that is given to the plant is a very important factor in determining the growth of the plant. The results of the study are given in the following table. The results show that the amount of water has a significant effect on the growth of the plant. The amount of water that is given to the plant is a very important factor in determining the growth of the plant.

This study yielded three categories of information, namely; the sociological factors, causative factors and the severity of injury. The sociological factors in this study bear a close relationship to what is happening in our society at present. Kaokab Karim et al (1974) in his study showed that burn injuries in children occur in overcrowded and poor housing conditions. He emphasized that lack of medical facilities and ignorance were associated with increased incidences of burns. Lack of parental care especially the mothers (Nagasaki 1974) is an important sociological factor in the cause of burns in children. Nagasaki found that such children sometimes experienced more than once in given period. M.H. Keswani (1975) found that majority of burns occurred at home, and that these were homes where life was difficult. Usually they were single roomed homes, there was floor level cooking, overcrowding was rampant and there were defective heating appliances with playful children.

The younger children tend to suffer from scalds. This is probably because they are usually confined to the house. Yiacoumettis et al (1975) analysed the causes of burns in children and showed that scalds were the commonest causes of burns. In some parts hot beverage (coffee) was the commonest causative agent. In his study he showed that burns due to flames were commoner in the older group of children. The causative agent being the matchstick flame. In this study hot porridge figures significantly as a common causative agent. Fire from the Jiko (charcoal cooker) is a common causative agent. This is probably because of the families analysed are of low socio-economic income, hence they use the charcoal burner as the means of providing

fire for cooking and warming. Wood (1979) also found the same in a rural community.

This study again showed that inflammable gases produce deep burns (Muir & Barclay). Hot flames or hot metal bars were also associated with deep burns. Involvement of clothes was not a significant factor in the extend of burns in this study. This is contrary to other studies elsewhere (Gordon et al).

#### Racial origin of parents

All the children seen in the Burns Unit were of African origin. These children came from approximately two hundred and sixty families (260). Eight (8) of the children were orphans. The remaining sixteen (16) were those who had received burns more than once in the two year period studied.

Kenyatta National Hospital is situated in Nairobi City where the concentration of all races is the highest in the country. However, it is clear that the patients treated must be self selected. The Hospital caters for the low income groups. The Africans who are economically well normally do not have their children admitted at this hospital. The Asian Community have their own community hospital where their children are treated. The white races have also their own hospitals. This factor therefore introduces unavoidable bias in the distribution of burns in the population around Nairobi Province. It is true that burns occur in children of other races, but one would need to extend his research beyond Kenyatta National Hospital in order to include them in such study (see table one next page).



**Table 1.**

**Racial Origin of Parents**

<b>Race</b>	<b>No. of patients</b>	<b>Percentage of series</b>
<b>Africans</b>	<b>248</b>	<b>100</b>
<b>Asians</b>	<b>0</b>	<b>0</b>
<b>Europeans</b>	<b>0</b>	<b>0</b>
<b>Others</b>	<b>0</b>	<b>0</b>

Occupational status of parents

Every parent or guardian was interviewed carefully to ascertain the nature of work he does. On this basis I divided the occupational status of the parents into various categories as shown in Table 2. This division reflects their economic income as well as their social status. 70% of the parents came from the unemployed or from the low income group. This percentage is very high compared to similar studies by Joseph et al (1979) in Australia. In this country there is no medical insurance covering such groups, and therefore they can afford to take their children only to Government hospitals like Kenyatta. Most of the manual workers work on sort of temporary terms. This they can lose their job any time, and one should perhaps regard them as a large group of unemployed.

Only seven (7%) per cent of the parents came from high income group, namely the professional and administrative group. When I talk of professional and administrative I include the doctors and administrators like the District Commissioner. This group of workers is well paid comparatively. They are covered by a medical scheme known as National Hospital Insurance Fund (N.H.I.F) which will pay for their medical expenses at any private hospital their children may be admitted. In addition to this they have got fixed amount of money to be spent on their medical bills, the amount depending on their seniority in the Ministry. Thus they are able to take their children with burns for out patient treatment in the private hospitals. This explains the reasons why their attendance at this hospital is low. From Table 2 it is also seen that the number of farmers is small.

I noted that most of the children of farmers did not come from Nairobi, but had to be transferred from the outlying districts. Most of them were in fact transfers from the District Hospitals. I would have expected the percentage of clerks and office workers to be higher but again this group usually is not well paid and they tend to have large families. However, this group is still the largest fully employed group that is in this series.

Description of Group	Percentage of Total
Professional and Administrative	7
Clerical and Office Workers	22
Farmers/Minors	1
Artisans/Laborers Domestic Service	28
Unemployed or Not Stated	42

**Table 2.**

**Occupational status of parents**

<b>Occupational Group</b>	<b>Percentage of series</b>
<b>Professional and Administrative</b>	<b>7</b>
<b>Clerical and other Office workers</b>	<b>15</b>
<b>Farmers/Miners</b>	<b>8</b>
<b>Craftsmen/Labourers Domestic workers</b>	<b>45</b>
<b>Unemployed or not known</b>	<b>25</b>

Marital status of parents

The marital status of parents was divided into five categories as shown in Table 3. This information was based on what every parent said himself or herself. No particular identification was asked for to prove what was said. In the case where the two parents were not living together as a family it was the parent who stayed with the child that was interviewed and recorded in the study. In the cases where the marriage was disturbed, it was sometimes difficult to categorise the status of the parent. A number of ladies were unwilling to be known as unmarried and usually gave fictitious names of husbands. In our society the terminology of separated marriage does not quite really apply. Usually the lady stays alone but she will continue to be visited by the husband irregularly and yet continue to bear children with the same man.

This pattern of marital status differs significantly from studies carried out in Australia and other developed countries. Joseph et al (1979) found that over 87% of all their parents were married. Unmarried mothers in their study was only 3%. In this study about one third of all the parents (mothers) were unmarried. This is proportionally much higher. 65% of all the mothers involved came from homes where marriage was at least superficially disturbed. It would therefore appear that burns are common in families where there is only one parent or the marriage is disturbed.

Majority of this unmarried mothers are young girls, usually school dropouts. They come from poor homes. They live with their parents or live alone in single roomed houses. Majority are temporarily employed, with poor monthly income. Their children are therefore at

higher risks of getting burnt. Leokaprio (1978) mentioned clearly that burns are common in difficult situations, such as poor housing and congestion. Usually the mothers find it necessary to leave the child under the care of somebody else while they go on duty.

Percentage of burns

State	Percentage of burns
Bihar	30
Madhya Pradesh	18
Uttar Pradesh	18
West Bengal	18
Andhra Pradesh	36

**Table 3.**

**Marital status of parents**

<b>Status</b>	<b>Percentage of series</b>
<b>Married</b>	<b>35</b>
<b>Divorced</b>	<b>5</b>
<b>Separated</b>	<b>18</b>
<b>Widowed</b>	<b>12</b>
<b>Unmarried</b>	<b>30</b>

Mothers' nature of work

The mothers were divided in three groups according to the nature of work as shown in Table 4. By full time work I mean those mothers whose work occupies the whole day from morning to evening, but are at home in the late evening and night. The part time workers are those who are away for only half of the day or only a few hours but come back at home. The mothers not working are those who are always at home with their children. They have no employment of any sort, personal or public and could be described as housewives. They depend on their husband or other people for daily needs of life.

In an urban centre like Nairobi the circumstances demand that everybody should be able to work in order to meet the daily demands. Life is expensive and this is why about 70% of all our mothers are working. There is no alternative but to work for salary. Consequently these mothers, in their absence must put their children under the care of somebody else. They usually employ young girls, to look after their children. These maids (ayas) are usually below twenty years of age. Thus a child is left to look after other children. This is because it is cheaper to employ the young girls as compared to employing an adult. As is shown in Table 9. usually there is no responsible adult at the time of the child being burnt. The employment of young maids is an economic necessity. This factor is associated with the increase of burns in children of mothers who are working. This is obvious when one analyses the results as shown in Table 9. In the civilised countries, the majority of women with the children do not work



until the children are of age. They devote their time to looking after the children. Joseph et al (1979) in a similar study, 75% of the mothers were not working, while only 12% were full time working mothers. The socio-economic conditions in Nairobi are such that the mothers have got to leave their children under care of somebody while they are working. This is associated with increased incidence of burns in this group of mothers.

STATUS OF MOTHER	PERCENTAGE OF BURNS
FULL TIME	12%
PART TIME	15%
NOT WORKING	73%



Number of children in a family unit

The number of children in the family unit is shown in Table 5. Each mother was interviewed to establish the number of children in her family. In some cases two families lived in the same house. In such cases the two families were counted separately. In some families there were children who belonged to relatives of the parents and lived with the family for one reason or another. Such children were counted as if they belonged to that family.

The distribution of children per family is what is expected for this country. Many people have large families. A minority of the population practices family planning and a minority see the need for a smaller number of children. From the studies over 70% of the families have more than four children. The families with a smaller number of children are usually young families, who are in the process of getting more children. It is just a matter of time and the family will become large. From Table 5 it is clear that majority of the children in the Burns Unit came from large family units. This observation could be explained in two ways: majority of families have got large numbers of children. Therefore by chance most children who are burnt will come from large families. It is also true that burns are more common in large families. These are the same families where the parents are low income earners and therefore belong to the low social group. They usually live in small houses, more often single roomed houses. Congestion is usually rampant. The fire places are on the ground level, and usually in the same room as the sitting room. This is in evidence of Leokaprio's statement that burns are more common in

difficult situations such as poor housing and congestion.

Number of children	Percentage of total
1	5.0
2	10.0
3	15.0
4	20.0

**Table 5.**

**Number of children in family unit**

<b>Number of children</b>	<b>Percentage of series</b>
<b>1</b>	<b>3.0</b>
<b>2 - 3</b>	<b>10.8</b>
<b>4 - 6</b>	<b>24.2</b>
<b>&gt; 6</b>	<b>62.0</b>

Previous accidents of Burnt children

It is known that some children may be prone to accidents. I therefore interviewed the parents carefully about the health history of their child. Apart from previous burns I asked whether the child had been involved in other accidents, as falling complicated by fractures or being hit by moving cars, or anything that made it necessary for the child to be treated or admitted to hospital.

85% of all the children had no previous history of burns as shown from Table 6. It is interesting that no parent was willing to give a history of epilepsy. This may be because traditionally epilepsy is supposed not to be revealed outside the family circles. However, 15% of all the burnt children had previously attended hospital for other injuries. In most cases the parents could not remember exactly the reason for attendance. This group would need further study in order to be able to indicate whether a child or family is accident prone or not.

**Table 6.**

**Previous accidents of burnt children**

<b>No. of accidents</b>	<b>Percentage of series</b>
<b>None</b>	<b>85</b>
<b>1</b>	<b>10</b>
<b>&gt; 1</b>	<b>5</b>

### Causation of scalds

Accidents due to Thermal injury are usually generally referred to as burns in a generic sense. There is usually no differentiation made between burns due to moist heat and those due to dry heat. In analysing the causes of burns it is necessary to make a definite distinction between the two causative agents. Scalds are due to moist heat, and burns are due to dry heat usually flame. Scalds are known to be more common in children than burns.

Kirkham (1974) in his study of a social survey of thermal injuries in South Australian children showed that scalds were the commonest thermal injuries usually below the age of ten years. The injury usually occurred within the house. Roding (1974), in epidemiological study of burn injuries in the German Democratic Republic also that scalds were commoner in children. The ratio of scalds to burns in children in most surveys is 2 to 1. Yiacoimeths (1976) et al made a detailed analysis of burns in children. He showed that majority of childrens burns occur indoors and that scalds were comparatively more common than burns.

I have in the oncoming pages analysed the various factors that are involved in the causation of scalds. In some cases I have compared in various tables the incidence of burns and scalds. In Table 7. I have compared at various ages the percentage of scalds and burns and Table 8. shows the two compared for sex. A detailed inquiry was made to establish the actual agent that caused the scalds. The pattern of scalding agents in Table 11 is similar to other studies elsewhere. Joseph



et al (1979) found that hot water was the commonest scalding agent of childhood burns. In my study porridge is undoubtedly the commonest cause in most families. As most of the scalding agents are common household foods and beverages, the children usually come in contact with them in the house.

Age of patients

Although burns are common in childhood, it is also known that there are peak incidences according to the ages. Table 7. shows the incidences of scalds and burns at various ages upto fifteen years of age. Majority of burns occur in the first three years of life, thereafter the incidence seems to decrease. The first three years is the toddler age when the children are exploring the environment for the first time in life. Both scalds and burns are equally common to this age.

In this study the burns and scalds occur with equal frequency. Joseph et al (1979) in their study found that both scalds and burns were commoner in the first three years of life. They also found that for burns, there tends to be a second peak incidence at around fifteen years of age. This incidence was attributed to children playing with explosives outside the house at that age. Usually the toddlers received injuries when they accidentally pulled a container into themselves, pulled a tablecloth or dipped their hands in a container.

Table 7.

Age of patients

<b>Age Yrs.</b>	<b>Total series % cases</b>	<b>Scalds % cases</b>	<b>Burns % cases</b>
<b>0 - 1</b>	<b>11.5</b>	<b>15.6</b>	<b>15.0</b>
<b>1 - 2</b>	<b>40.2</b>	<b>50.2</b>	<b>27.0</b>
<b>2 - 3</b>	<b>13.5</b>	<b>10.2</b>	<b>20.3</b>
<b>3 - 4</b>	<b>8.0</b>	<b>8.2</b>	<b>15.4</b>
<b>4 - 6</b>	<b>9.0</b>	<b>5.4</b>	<b>9.1</b>
<b>6 - 8</b>	<b>5.4</b>	<b>3.0</b>	<b>5.8</b>
<b>8 - 10</b>	<b>5.5</b>	<b>3.5</b>	<b>3.0</b>
<b>10 - 12</b>	<b>5.0</b>	<b>3.2</b>	<b>2.0</b>
<b>12 - 14</b>	<b>1.9</b>	<b>0.9</b>	<b>1.6</b>

Sex distribution

There is a definite male preponderance for both the scalded and burnt patients. Table 8 shows this sex distribution for scalds and burns. The overall ratio of males to females is two to one. This is now a common finding in most studies on childhood burns. Muir and Berkelay found the ratio of boys to girls to be two to one in their studies. T.P. Joseph et al (1979) had similar findings in a South Australian study of childhood burns.

No adequate explanation has been given for the finding that male children are more prone to thermal injuries than the female children. Some authors think this is because boys are more daring, more active, and therefore come in contact with many things than their female counter parts. On the contrary some authors think that boys are clumsy, careless and less intelligent at younger ages, that the frequency of burns in boys is a reflection of their less intelligence compared to girls at that age.

**Table 8.** SEX DISTRIBUTION OF CASES OF SCALDS

Among the burning of all persons it was found that the majority of cases were males. The percentage of males was 60.2 and of females 37.8. This ratio is similar to that of other burns.

**Sex distribution**

The sex distribution of cases of scalds and burns is shown in the following table. It is apparent that a greater percentage of scalds and burns are sustained by males than by females.

Sex	Total series % cases	Scalds % series	Burns % series
Male	60.2	52.3	63.9
Female	37.8	47.7	36.1

The sex distribution of cases of scalds and burns is shown in the following table. It is apparent that a greater percentage of scalds and burns are sustained by males than by females. The percentage of males is 60.2 and of females 37.8. This ratio is similar to that of other burns.

Responsible adult at time of injury

Among the working lot of parents it has become the routine for their children to be entrusted to somebody else to look after them when parents are away working. This habit is common in all the urban centres. This is purely an economic necessity as both parents need to combine their income in order to meet the daily needs of life. It is expensive for a family to employ an adult to look after their children. Moreover the Labour Ministry has properly laid down rules and salaries of adults in all urban centres, and they are enforced through the workers unions. It is not therefore possible to underpay a worker in the urban centres.

Most families have therefore resorted to employing young children to look after their babies and children. It is cheap to employ these "Ayaas" as they are commonly called. Majority of this type of workers are below the age of fifteen years. The result is that a bigger child is employed to look after smaller children. When a child is burnt usually the parents bring the child to hospital. Good detailed history of what happened usually reveals the parents ignorance about the details of the accident. At that time the parents will admit that they were not present at the time of injury. It was therefore necessary to get a detailed history of the events of the accident. I had to inquire carefully about the age of the maid who looks after the children. Sometimes it was difficult to establish who was responsible for the child at the time of the accident. In Table 9, the word "others" refers to the maid or any responsible adult present at the time of injury. Most families also stay with adult relatives and whenever an adult relative was with the

children I assumed that the relative took the responsibility for the children. A significant finding is that approximately 80% of the parents were not present at the time when the children received the thermal injury. Over 50% of those present at the time of injury were not parents, but either a maid or some other responsible adult, living with the family. These results differ markedly from those published by other researchers especially from the developed countries. T.P. Joseph et al (1979) found that 80% of all the parents were present at the time of accident. Only 12% had other responsible people present at the time of injury and no responsible adult was present in only 7% of the total cases.

These results show clearly that the majority of children are left without parental care. Most parents leave either a relative or an employee (usually another child) to look after their young ones while they are away. This factor must be important in the causation of thermal injuries. Most of these injuries are self inflicted. The child was responsible for the events that led to the hot liquid pouring on it. It is only a small percentage when scalding agent was tipped over the child by another person.

**Table 9.**

**Responsible adult at time of injury**

<b>Adult/Parent</b>	<b>Total series % cases</b>	<b>Scalds % cases</b>	<b>Burns % cases</b>
<b>One or both parents</b>	<b>21.4</b>	<b>33.2</b>	<b>28.3</b>
<b>Others</b>	<b>54.6</b>	<b>48.8</b>	<b>55.2</b>
<b>None</b>	<b>24.0</b>	<b>18.0</b>	<b>16.5</b>

... The ... of the ... and ...  
... The ... of the ... and ...  
... The ... of the ... and ...  
... The ... of the ... and ...  
... The ... of the ... and ...  
... The ... of the ... and ...  
... The ... of the ... and ...  
... The ... of the ... and ...  
... The ... of the ... and ...  
... The ... of the ... and ...

The ... of ... in ...

### Places where accidents occurred

For every child with a thermal injury a careful history was taken to know where exactly the accident happened. If it was in the house the exact place was named. Most of the children in this series came from homes where they lived in a single roomed house. In such cases it was difficult to appreciate exactly the part of the house where the accident occurred. The various places where accidents occurred are grouped in Table 10.

Comparative occurrences of scalds and burns in the various places is shown in Table 10. Scalds commonly occurred in the kitchen. This is understandable as the kitchen is the place where most cooking and boiling of hot liquids is done. Majority of these were self-inflicted. Usually the child suddenly pulled or pushed or knocked off a container of hot liquid. Flame injury was not as common in the kitchen as scalds. Probably this could be explained by the fact that most of the fire agents were either well protected, or cooking was done in the presence of an adult. This acted as a limitation to the behaviour of the child. Most children also tend to realise the danger of hot flames, but rarely do they realise that a hot liquid can burn them. The second commonest place where scalds occurred was in the dining room and sitting room. Most children came from homes where the dining and sitting rooms were one and the same place. These accidents tended to occur at meal times. The child pulled a bowl of soup onto itself, or another poured the hot soup on the other.

The distribution of flame burns in various places



is significantly different from the scald cases. Majority of burns cases occurred outside the house. Usually this involved male children playing outside the house. A number of the cases were due to matchstick flames. The children went on match stick lighting play, usually burning each other in the process. In some cases the children had lighted fires and were cooking or roasting potatoes while looking after their parents' animals. More than 25% of all the flame burns occurred in the kitchen. Usually these were caused by a heated agent. A common cooking stove known as Jiko was a frequent cause of burns. Jiko, a cooking stove is the cheapest cooking agent found in most families. It is a charcoal burner, which gets hot as the cooking continues. The toddlers are the usual victims of the charcoal burner. The burns cases that occurred in the sitting room were common at night and especially during the rainy, cold season. During this period an open fire a Jiko was used for warming. Again the toddlers were the usually victims, occasionally the elders received burns when they fell in the Jiko as they continued to warm close over the fire. Isolated cases of flame burns occurred in other places, like of petrol stations, in motor car places, and outbreak fire in public places. Usually such involved mainly adults and a few children. Scalds as shown by these results are household thermal injuries while flame burns may occur indoors as well as outdoors.

**Table 10.**

**Place where accident occurred**

Place	Scalds % cases	Burns % cases
<b>Kitchen</b>	<b>71%</b>	<b>28.0</b>
<b>Dining/Sitting Room</b>	<b>12.4%</b>	<b>21.3</b>
<b>Bathroom Laundry</b>	<b>6.0%</b>	<b>1.3</b>
<b>Outdoors</b>	<b>8.0%</b>	<b>31.2</b>
<b>Others</b>	<b>2.6%</b>	<b>17.6</b>

### Scalding agent and depth of scalds

For every child with a scalding injury a detailed account was recorded regarding the nature of the scalding agent. The agents were in general of fluid type as shown in Table 11. It was important to know the exact nature of the fluid that caused the injury. The liquids incriminated were mainly the common household liquids. For every agent involved I also recorded the number of deep burns associated. The only way to compare the severity of various agents is to be able to measure the severity of injury associated with it. I chose the depth of burns as a measure of severity. When a patient receives a burn, it is difficult at the time of accident to be certain whether a burn is superficial or deep. It is only a subsequent follow up that one can make the decision with precision. This is more so especially in burns caused by inflammable gases. This observation can only be followed up on patients who are admitted and thus available to you all the time. In this study it was difficult to follow up the out patient cases as they always absconded treatment, and had very irregular attendances.

Water was the commonest scalding agent, accounting for approximately 50% of all the cases. Usually this was hot water, being prepared for washing or cooking. Toddlers were the usual victims of this injury, usually knocking off the container or falling in the container of hot water. Young girls, around puberty, were also involved. This happened when these girls were cooking in the kitchen, either alone or helping their mothers. Porridge, a common light meal for most families accounted for approximately 30% of all the cases. Porridge is

used during breakfast and can also be served at any other time. It is usually prepared on sufurias and must boil hot for it to be ready. It is at this stage when burning accidents occur. The accident is usually self inflicted by the child. From Table 11. milk appears to be a rare cause of scalds. This could be explained in many ways. Most of the milk may be used without having to boil, or may need only warming before use. Milk is an expensive item, and probably milk is rarely used by most families, especially the low socio-economic groups. Thus the incidence of scalding injury from milk is less compared to other agents, like porridge.

All domestic containers of hot liquids were involved. In my series the cup and the sufuria were the commonest containers implicated. In the toddler age group, the majority of scalds occurred in one of the two situations. Those occurring in the kitchen happened when the toddler pushed its hands into the hot liquid, or pulled a cup or a jug of hot liquid from the stove, Jiko, or pulled a table cloth over itself, or grabbed the edge of a table cloth and dislodged the container of hot liquid on to itself. The dining or sitting room accidents were similar to what happened in the kitchen. The bathroom scene was slightly different in that either it involved a toddler who fell into a bath of hot water or the bigger child turns on the hot water tap and climbs out of the bath leaving the younger child.

Table 11.

Scalding agent, and depth of scalds

Scalding agent	% of cases	% deep burn
Water	48.3	28.7
Tea	12.0	12.0
Coffee	6.4	16.9
Milk	3.2	5.5
Porridge	28.9	21.4
Others	1.2	15.4

### Severity of scalds

Scalds are much more commoner childhood thermal injuries than burns. However they are less severe than the burn injuries. The severity of a scalding agent depends on many factors. The nature of the scalding agent is important. A scald from steam is likely to be more severe than a scald from just hot water. This is because steam is at higher temperature than water alone. Similarly a scald from boiling soap is much more severe than that of plain hot water. The extent of the scalds on the body will be influenced by the manner in which the scalding agent falls on the body. A child falling in a bath of hot water will obviously have a large extent of injury. Thus the size of the container involved seems to have a direct relationship to the size of the burnt area. It is also true to say that the age and the size of the person involved will determine the extent and severity of the scald. The younger the child the more severe the injury. In this series one hundred and ninety-three patients had scald injuries (77% of total series). Of this number 32% had injuries of more than 10% in extent.

The depth of the wound is a good parameter in measuring the severity of a scalding agent. As to whether the scalding wound will be deep or superficial depends also on many factors. Most of the factors have already been explained in the previous paragraph. Nature of liquid, amount of liquid and age of the patient are factors influencing the extent as well as the depth of the wound. The temperature of the scalding agent has a much more influence on the depth of the wound. The higher

the temperature, the more deeper the wound is likely to be. 30% of all the scalds resulted in deep wounds requiring skin grafting. In this series plain hot water was more associated with deep wounds. The nature of the container does not seem to have influenced the depth of the wound. Table 11. shows the various scalding agents and percentage of deep burns produced by the agents.

Table 11. shows the various scalding agents and percentage of deep burns produced by the agents. The data shows that the most common scalding agent was plain hot water, which accounted for 30% of the total scalds. Other agents included hot oil, hot steam, and hot metal. The percentage of deep burns ranged from 10% to 30% depending on the agent. The most common cause of deep burns was plain hot water, which accounted for 30% of the total scalds. Other agents included hot oil, hot steam, and hot metal. The percentage of deep burns ranged from 10% to 30% depending on the agent.

The data shows that the most common scalding agent was plain hot water, which accounted for 30% of the total scalds. Other agents included hot oil, hot steam, and hot metal. The percentage of deep burns ranged from 10% to 30% depending on the agent. The most common cause of deep burns was plain hot water, which accounted for 30% of the total scalds. Other agents included hot oil, hot steam, and hot metal. The percentage of deep burns ranged from 10% to 30% depending on the agent.

### Causation of Burns

Causes of burns differ from those of scalds. This difference is not only in the causative agents, but also in socio-economic aspects. As seen from Table 7, flame burns are more common in the older children. Most of the children received their burns outside the house. The accident involved matchsticks, usually trying to light a fire in dry grass or lighting old papers. The younger children (toddlers) received their burn injuries in the house. This involved the common cooking agents and the common heating or warming instruments. Again the accident in most cases was self inflicted, the child touching a burning stove, firewood flame or a hot charcoal burner. 63% of all the children who received burns were of the toddler age group.

The fire agents used in the houses were mainly portable and were on the same level as the floor. It is therefore important to note that the fire agents are not protected at all. The level at which most burners were put made it possible for the toddlers and other children to come into contact with fire easily. It is therefore not surprising that a high percentage (61%) of all the children were toddlers. There is male preponderance for the flame burns as compared to the scalds. I noted earlier that flame burns tend to be more common at the older ages, and that majority of these burns occur outside the house (see Table 7.). That boys were the commoner victims of these burns can be explained in many ways. Boys traditionally are more active than the girls. They are allowed more freedom to be outdoors and play as much as possible. It is during this time that most burns occurred. Usually the boys involved in crack



fires or making fires for other reasons. They are allowed to use matchsticks for lighting. Table 8. shows the male preponderance for burns while in Table 10. it is shown clearly that more burns occurred outdoors compared to the scalding injuries. Many types of burning agents were involved. The commonest were the charcoal burner and the firewoods. However, this I will analyse in the following pages.

I did find a time variation in the incidences of burns, showing clear peaks of variation of occurrences. There were two peaks, a morning and evening peak. The morning peak was smaller compared to the evening one. The colder months of June and July obviously had more cases of burns. T.P. Joseph et al (1979) had similar findings in his study of childhood burns in Southern Australia. He noted that during the cold seasons the number of burns increased. This was usually due to the fact that most children were burnt while warming themselves. Also because during the cold season most children were confined to the house and therefore received burns indoors. Evenings tend to be cold in Nairobi and thus most children receive their burns during that time.

### Burns Ignition agents

All children admitted to the Burns Centre were interviewed in a detailed way to find the cause of the burns. Most of the children came from poor families and therefore led a less sophisticated family life. The commonest and simplest agent was the charcoal burner. This type of burner is loaded with charcoal which are initially ignited with flames made out of dry paper. Once the charcoal gets fire it burns for a long time. There are two ways in which the children received their burns from this agent. The top of the burner is open, and children placing their hand on top received burns. This was common with toddlers who are exploring the new world all the time. The sides of the charcoal burner is made of iron walls and at the charcoal burns the sides become equally hot. Children accidentally or intentionally touching the sides of the charcoal burner received burns. This was seen in both toddlers as well as the older children.

Firewood is commonly used to make fire. Firewood was a common burning agent especially in those families which live on the farms. Fire is made in the house for cooking. Traditionally three raised stones on the floor are the basis for support of the cooking pot. Such fires are so exposed that it is easy for children to receive flame burns from firewood because the fire place is at floor level and usually not protected. There was nobody with sunburnt accidents. This injury is known to occur usually in white skinned people, very rare it is in negroid people. Electrical instruments as burning agents contributed only 2.1% of the total burns. This is because these types of instruments only are in rich families and

most of the patients in this series came from the low socio-economic group.

The inflammable liquid commonly involved was paraffin. Paraffin is used as a household agent for many purposes. It is usually used in hurricane lamps for providing light and is also used in pressure stoves for cooking. Many burns have been caused during explosion of this paraffin container during attempted lighting.

It is interesting to note that associated burning of clothes does not appear to be significant in majority of these cases. For every child burnt I took a detailed history as to whether clothes were involved or not. Majority of the burnt children were brought to hospital without clothes. Usually covered by a sheet or some towel. Attempts to know what type of clothes was worn at the time of accident were unfruitful. Most parents would not remember whether the child had clothes or not. Those who remembered could not know whether the clothes were burnt at the same time or not. The other interesting finding was that some children stay without clothes. Thus ignition of clothes is not an important factor in the severity of burns.

**Table 12.**

**Burns Ignition agent**

<b>Agent</b>	<b>% cases</b>	<b>% deep burn</b>
<b>Charcoal burner</b>	<b>43.5</b>	<b>3.4</b>
<b>Inflammable liquids</b>	<b>16.7</b>	<b>65.8</b>
<b>Domestic heater</b>	<b>6.4</b>	<b>2.8</b>
<b>Electrical instrument</b>	<b>2.1</b>	<b>1.7</b>
<b>Firewood</b>	<b>28.7</b>	<b>19.3</b>
<b>Sun burnt</b>	<b>0.0</b>	<b>0.0</b>
<b>Others</b>	<b>2.6</b>	<b>7.0</b>

### Severity of Burns

Burns caused by dry heat (flame) on the whole are more severe than those caused by moist heat. Nagasaki (1976) in a statistical analysis of burns at Nagasaki Hospital found that the most extensive burns were caused by the inflammable liquids in patients who wore highly inflammable clothes. These burns tend to be deep also. The inflammable liquids when ignited produce flames of very high temperatures. Majority of the deep burns were caused by flame burns and especially the inflammable liquids like paraffin and petrol. 25% of all the burn cases had lesions involving more than 10% of the body surface. The involvement of clothes increases the severity of burns, both in extent and in depth of the wound. Similar findings were reported by Roding (1978) in his study of epidemiology of burns in Germany. Most authors found that in cases where clothes were involved usually more than 50% of the cases had 10% or more of body surface involvement.

More than half of the burnt children sustained full thickness burns requiring skin grafting and of those whose clothing was involved in the burn, more than 50% suffered deep burns as compared to 31% who had no clothes involvement (see also Table 13.). Childhood burns in my series carried a mortality of 6.6% . There were various factors associated with mortality. Majority of these children were initially malnourished. Their burns were always infected. The burns were extensive, so that all those who died had more than 15% of burns. 40% who died had bacteriological proven infection with pseudomonas. Muir and Barclay found that Pseudomonas infection is associated with high mortality.

In this study house fires and inflammable liquids caused more extensive damage than other agents. The inflammable liquids caused invariably deep burns. The role played by clothing in severity of childhood burns was not clear, because most burnt children came to hospital naked. Many parents and guardians could not remember whether or which clothes the child wore at the time of the accident.

Supplement of severity	% of all cases	Clothing involved	Clothing not involved
Electric Circuit accident	14.8	14.2	14.8
Gas accident	10.2	10.2	10.2
Match accident	10.1	10.1	10.1
Other	11.8	11.8	11.8
Unspecified	5.2	5.2	5.2

Table 13.

Severity of accidents

<b>Parameter of severity</b>	<b>% of all cases</b>	<b>Clothing involved</b>	<b>Clothing not involved</b>
<b>Extents:</b> <b>&lt; 10% body surface</b>	<b>34.6</b>	<b>56.2</b>	<b>76.1</b>
<b>&gt; 10% body surface</b>	<b>65.6</b>	<b>43.8</b>	<b>23.9</b>
<b>Depth:</b> <b>Superficial</b>	<b>68.7</b>	<b>54.2</b>	<b>65.0</b>
<b>Deep</b>	<b>31.3</b>	<b>45.8</b>	<b>35.0</b>
<b>Mortality</b>	<b>6.6</b>	<b>4.2</b>	<b>3.8</b>

## CHAPTER 4

### CHAPTER 4

### DISCUSSION



## DISCUSSION

In many parts of the world thermal injury is the commonest childhood accident (McLoughlin 1979, Leokaprio 1978, Keswani 1977, Nagasaki 1974, Thomas et al 1978). Although thermal accidents may occur at all ages, there are special features associated to thermal injuries at the childhood age. Thermal accidents tend to be the same in all parts of the world. The symptoms and the features of thermal accidents are obvious and universal and are readily recognised by both the layman and the doctor. Diagnosis is made on history and clinical examination. Thermal injury is a unique accident in that it arises out of the society and its management depends on the doctor identifying the factors in the society that are associated with its occurrence and prevalence (Leeder 1976, Pappetal 1976, Jay et al 1977, Moserova 1974). The socio-economical factors, associated to thermal injuries fortunately tend to be the same in all parts of the world. This probably makes it easy for one to define a common strategy for the elimination or prevention of thermal injuries.

In the underdeveloped countries infective diseases are the commonest cause for admitting a child to hospital. Malnutrition and infective disease therefore overshadow the seriousness of thermal injuries (Kenyatta National Hospital Medical Records, O'ya et al 1978, Jay et al 1976, Bovayad et al 1976, Arora et al 1975, Wallace 1974). In most of the underdeveloped countries there are no wards or special burns' centres to cater for the burned patients. These patients are mixed with the general surgical patients and managed by a medical officer. In the last ten years many of the developing countries are beginning to realise the need for Burns centres as the incidence

of thermal accidents increase and the incidence of malnutrition and infection decrease (Leeder 1978, Uzel 1978, Muir and Barclay). It is predictable therefore that in future the importance of thermal injuries will be appreciated and that management of these accidents will improve.

Thermal injuries (burns) are known to occur commonly in difficult situations, such as poor housing, congestion, in drunkards, epileptics and leprotic people (McLoughlin et al 1979, Leokaprio 1978, Keswani 1978, Waisbren et al 1978, Roding, 1978). Children need adult care to prevent them from being involved in accidents. This study has shown clearly that the presence of an adult is an important factor in reducing the incidence of burns in children. The study has revealed that majority of the children received their burns when they were left under the care of another child or when there was no responsible adult with them.

Majority of the children who received burns came from the low socio-economic homes. This is reflected in the occupational status of the parents as shown in Table 2. It is in these types of homes where congestion is prevalent. The family lives in a single roomed house. As the study has shown most families have more than four children. All these factors are associated with increase in the number of thermal injuries. It is assumed a large number of children in a congested place cannot be controlled easily and that in a single roomed house the children have an easy access to fire.

Parental care of the children is important in the prevention of thermal injuries.

70% of the children came from homes where marital status was at least disturbed as shown by Table 3. Thus the children had either no parent or only one parent available. Perhaps the most important parent is the mother. This study has shown that the children of mothers who are employed on full time work had a higher number of burns as compared to those mothers who are unemployed and stayed at home with the children. In the absence of the mother, the children are prone to accidents as there may be nobody to prevent them from coming into contact with fires and other thermal agents.

Some authors believe that there is a small section of children and adults who are accident prone and that prolonged follow up of this group of people will reveal the frequency of accidents associated with them. (Joseph et al 1979, Muir and Barclay, Leokaprio 1978, Fowler 1977, Bhatnagar, 1975). Usually there is a predisposing factor involved such as epilepsy, drunkardness, leprosy or mental retardation. In this study only 5% of the children had more than one previous accident. They were in all fifteen children out of the total of two hundred and eighty-four children seen. One would need a further detailed study of this group to be able to know whether a child is accident prone or not. I would therefore say superficially that there are children who are accident prone. If a child is labelled accident prone, then it is mandatory for the medical worker to find the underlying factors.

In childhood injuries sex and age are relevant factors associated with thermal accidents (Keswani 1978, O'ya et al 1978, Ramirez et al, Thomson et al 1978, Pegg et al 1979). There is a definite male preponderance. Most authors find a ratio of male to female of

2 to 1, some studies have had a ratio of 3 to 1. In this study there was a male preponderance with a ratio of male to female of 2 to 1. No adequate explanation have been given for this observed difference. Some authors think that boys are more active and more venturing than the girls, and therefore they are likely to be involved in more accidents than the girls. However some think that boys at younger ages are more foolish and clumsier than the girls and the increased incidence of accidents among them is a reflection of their low intelligence at this childhood period. This observed difference needs further study to be able to get an acceptable explanation.

Children in general are the common group affected by thermal accidents. This study included children upto the age of fifteen years. The peak of accidents were found between the ages of one year to five years. The toddler age group was particularly prone to thermal injuries. In the first three years of life the toddlers will touch, pull, push and try at anything that is within their reach. The accidents are usually self inflicted and in a few cases the other children are responsible for burning the child. What is important to realise is that these accidents are largely preventable if the toddlers are looked after by an adult and proper safety against fire burns is ensured in the house and at large.

An understanding of the common places where childhood thermal injuries occur is useful in considering preventive measures of these accidents (Keswani 1978, Waisbren et al 1978, Nagasaki 1978, Joseph et al 1979). In this study majority of scalds occurred indoors. Of the scalds only 10% occurred outdoors. The kitchen was a frequent site of burns, in this study, followed by

the sitting room and dining room. In cases of single room houses, it was difficult to name the site of the accident. From the study it is quite clear that the problem of childhood burns is a household insecurity. This is probably a reflection of lack of safeguard for the fire places and other thermal agents. Thermal accidents caused by flame showed a significant difference relative to the site of accidents. Over 30% of flame burns accidents occurred outdoors. This usually involved the bigger children who received the burns while playing with lighted fire in the open air. The bigger children also were involved in flame burns accidents in other places, such as workshops, factories, petrol stations and such like outdoor places. This study therefore reveals that childhood thermal accidents could only be reduced if preventive measures in the house are taught and practised by the parents and guardians of the children.

In analysing the agents of thermal injuries, it is necessary to divide thermal injuries into those caused by moist steam (scalds) and those caused by dry steam or air (burn) or flame. The agents of scalds differ from those of flame burns. All the scalding agents are liquids, majority being those commonly used in the house. Approximately 50% of the scalds in this study were caused by hot water or moist steam. This was hot water not mixed with anything. Usually this was water being prepared for use in the house for various reasons. The commonest reason was water being heated in preparation for food. Porridge was also a common cause of scalds. This is a common food in nearly all families that were involved in this study. The frequency of other agents can be seen clearly in Table 11. The accident again was usually self inflicted by the child. The charcoal

burner was found to be the commonest burning agent in this study. The child sustained the burn in either of the two ways: child received the burn by touching the hot sides of the charcoal burner, or the child sustained a burn by touching the hot lighted charcoal pieces in the burner. Charcoal burners are a cheap means of a cooking agent. They are portable and can be placed in any part of the house and cooking continued. There is no safe protection around the burner. It is therefore not a wonder that the charcoal burner is a frequent cause of flame injuries. Firewood injuries occurred in about 30% of all the cases of burns. These were seen mainly in children from the rural areas, where normally large fires of firewood are made. These fires are used for cooking as well as for warming. The fire places are not protected. The children therefore received self inflicted burn injuries as they played around these fires while warming themselves.

The inflammable liquid most involved was paraffin. Paraffin is used in pressure stoves for cooking and it is also used for lighting in the house in small home made tins. A number of these cases were due to explosions of the lighted tins. In such cases both children and adults were involved. Usually the burns were severe and deep. Petrol and diesel burns were rare, but severe whenever they occurred. Burns from electrical instruments formed only 2% of the total burns seen. Table 13 shows the percentage cases of various agents. Again it is important to note that the agents of burns were the common household agents.

The severity and seriousness of thermal injuries in children cannot be underestimated. Thermal injuries are the commonest cause of accidents in childhood years.

They carry a morbidity and a mortality which is substantially higher than the average everyday domestic injuries probably comparable only with the serious vehicle accidents that are a common cause of morbidity and mortality in this country. They are invariably painful injuries. They are associated with prolonged stay in hospital. Thus prolonged stay in most patients is associated with deleterious psychological complications, for the patient as well as the family. Rarely a complete recovery can be expected. Most patients remain with permanent scars for life. Other patients are crippled by the resultant contractures. Those with extensive ugly scars and contractures need a concerted effort to rehabilitate them. Often rehabilitation is never completely successful. Reports of suicide are well documented.

Many of these thermal injuries are caused by preventable factors (McLoughlin et al 1979, Leokaprio 1978, Keswani 1978, Oy'a et al 1978, Papp et al 1972). This study has attempted to outline most of those factors in the preceding chapters. Health education of the people, legislation to protect all fire places and thermal agents, and improvement of the living standards would go a long way in reducing the incidence of thermal injuries in our society and country as a whole. These measures would make a substantial contribution to public health. This study therefore devotes the last chapter on "Prevention of Thermal Injuries".

EXPERIMENTAL AND PREVENTIVE MEASURES FOR THERMAL INJURIES

CHAPTER 5

CONCLUSION

AND

PREVENTION

OF

THERMAL INJURIES



## CONCLUSION AND PREVENTION OF THERMAL INJURIES

A total of two hundred and eighty-four children suffering from thermal injuries were admitted to the Burns Centre at Kenyatta National Hospital over a period of two years. For every child a detailed analysis of his/her socio-economical background was carried out. Similarly the actual aetiological factors involved were analysed. From this study the following conclusions were made:

1. (a) Thermal injuries are common among the children who come from the low socio-economical groups. These children live under difficult situations. They live in single roomed houses. They are many in the family and there is congestion in the house.
- (b) Most of the children get burnt when the parents are away. Presence of parents is needed in order to reduce the incidence of burns. Because of economical factors most parents are away working leaving their children without a responsible adult person to look after them.
2. Majority of thermal accidents occur in and around the house. The accidents are usually self inflicted. The toddler age group is especially vulnerable to these accidents. The injuries are much more common among male children than the female ones. More injuries occur during the cold season, and majority of children get burnt during the time of cooking especially in the evenings.

3. The scalding and burning agents of thermal injuries are usually the common household agents. Hot water is a common scalding agent in many families around Nairobi. The charcoal burner is a common burning agent in burn injuries.

4. (a) Most fire heaters and fire places in the houses have no safety protection against thermal accidents. The Jiko or the Charcoal burner is a common fire heater which is portable and has no safety protection against burns.

(b) There is a need for everybody to be educated about the hazards of fire to children in particular and adults in general. It is possible for burns to be prevented instead of being cured.

## PREVENTION OF THERMAL INJURIES

Childhood burns are largely preventable. It is important that every member of the society should be made to understand the hazards of thermal injuries to children. A comprehensive approach to this problem and a practical programme are needed to reduce the number of childhood thermal accidents. In this study I have therefore, found it necessary to conclude by giving an outline on the prevention of thermal injuries.

Education of the public is of utmost importance in the prevention of burns. This would need some form of National programme, either on voluntary basis or at official Government level. Such a programme, organised from the grassroots to the top would be effective in reaching the masses. The usual means of reaching the public would be used including use of posters and pamphlets and lectures with visual aids. Important groups of people such as doctors, nurses and teachers would have to be given priority in the programme.

An introduction of "child safety" in the school curriculum would have far reaching effects in disseminating this information. This section of the course would cover child safety with an emphasis on thermal injuries. This section should be made compulsory teaching and the children be examined in the subject. In this way the parents of tomorrow will be aware of the hazards of burns and therefore be able to protect their children from thermal accidents.

This study has shown that most heaters are not guarded against burns and that fire places are not built

with safety standards. Legislation would therefore be useful in controlling the sale of unguarded heaters. Also the law would need all fire places to be guarded against causing burns. Highly inflammable clothes would be labelled so and a warning written on such material. It is hoped that these measures would help reduce the epidemic of childhood thermal accidents.

1954, 1955

It was found during the summer of 1954 that the...

1956

During the summer of 1956 it was found that...

1957

During the summer of 1957 it was found that...

1958, 1959

During the summer of 1958 it was found that...

1960

During the summer of 1960 it was found that...

1961

During the summer of 1961 it was found that...

APPENDIX A

DEFINITIONS

Superficial burn

A burn which leaves part or the whole of the germinal epithelium of the skin intact.

Deep burn

A burn which destroys the germinal epithelium of the skin.

Scalds

Injury to tissues caused by moist heat.

Burn

Injury to tissues caused by dry heat.

Thermal injury

Injury to the body caused by heat.

Jiko

Locally made fire heater, which utilises charcoal for producing heat.

Ayaa

Name referring to (usually) a female servant employed in the house to look after the children and help in other house work.

ACKNOWLEDGEMENTS

I am grateful to Mr. Mbalu, Senior Lecturer University of Nairobi Medical School for invaluable advice during the initial and final stages of this study.

To all the staff of Burns Unit at Kenyatta National Hospital who helped me to collect the datae for this study. My special thanks to Sister Ole Pasha who is incharge of the Burns Unit.

To the staff of the Medical Records Department for allowing me to use their files and other available datae necessary for this study.

To the Surgical Registrars and the nursing staff at the Burns Unit who looked after the patients discussed here.

Finally I wish to record my gratitude to Miss Loise Mwendia for typing this dessertation.

1. J. H. ...  
 2. ...  
 3. ...

REFERENCES

1. ...  
 2. ...  
 3. ...  
 4. ...  
 5. ...  
 6. ...  
 7. ...  
 8. ...  
 9. ...  
 10. ...  
 11. ...  
 12. ...

1. E. McLoughlin et al Burns Education. Burns Vol. 6 No. 1 Sept. 1979.
2. E.J. Combes and G.P. Batstone, P. Levick and P.G. Shakespear. Burns Vol. 6 No. 1 Sept. 1979.
3. Leokaprio, International Congress on Burn injuries, Burns Vol. 5 No. 1 Sept. 1978.
4. M.H. Keswani, Burns Vol. 5 No. 1. A decade in the field of Burns Prevention.
5. Hidejiro O'ya, Sciichi Ohmori, Burns Vol. 5, No. 1 Sept. 1978. Most Burns are preventable.
6. P. Gordon and T.A. Pressley Burns Vol. 5 No. 1, 12 - 18.
7. Franas S. Knox III et al. Burns Vol. 5 No. 1 19 - 29.
8. B.A. Waisbren et al. Burns Vol. 5 No. 1, 30 - 35.
9. J.D. Flora et al Burns Vol. No. 5, 36 - 42 Length of stay and survival for burned patients.
10. E.H. Margosches et al. Burns Vol. No. 5 43 - 53. Stastical analysis of burned patients data.
11. T. Nagasaki. Burns Vol. No. 5 60 - 61 statistical analysis of burns at Nagasaki Hospital in Hiroshima.
12. Cheryl J. Leeder. Burns Vol. 5, 62 - 63. Development of Burns Unit guidelines.



13. A.T. Ramirez and L. Bajarias Burns Vol. 5, 64 - 67.  
Burns Survival in a developing country.
14. S. Uzel and Nik Baran. Burns Vol. 5, 68 - 71.  
The first Burns Centre in Turkish armed forces.
15. M. Thomson et al. Burns Vol. 5, 72 - 78. The  
total number of burn injuries in a Scandinavian  
population.
16. Bjorn Palmer et al. Burns Vol. 5, 79 - 82 Patients  
with healed major burns in hot and cold environments.
17. Jill Fowler, Burns Vol. 5, 83 - 85 Child maltreat-  
ment by burning.
18. Jill Fowler, Burns Vol. 5, 86. The role of Parent  
groups in the rehabilitation of the burned child.
19. Cheryl J. Leeder. Burns Vol. 5 89 - 91. Families  
of Burn Victims receive help through regular group  
meetings.
20. T. Papp et al. Burns Vol. 5, 92 - 93. The health  
education of inpatients on the prevention and first  
aid of burns.
21. E. Read. The education of burned in hospital. Burns  
Vol. 5, 94 - 96.
22. Robbi D. Simons et al. Burns Vol. 5, 97 - 100.  
The burn victim: his psychological profile and  
post injury career.
23. A. Murray Clarke and H.L. Martin. Burns Vol. 5,  
101 - 104. The effects of previous thermal injuries

- on adolescents.
24. Jay K.M. et al. American Journal of Trauma 17, 948. Prevention and Burn epidemiology.
  25. S. Kirkham. Burns Vol. 5, 199 - 201. A social survey of thermal injuries in South African Children.
  26. R. Bovayad Agha and A Benhamla Burns Vol. 5, 204 - 205. The epidemiology of Burns in Algiers.
  27. Thermal injury units in rural settings.
  28. Hans Roding. Burns Vol. 5, 208 - 209. The epidemiology of burn injuries in the German Democratic Republic.
  29. M. de Kock: Burns Vol. 5, 210 - 211 The Cape Town Burn profile.
  30. Professor W. J. Rudowski. Treatment of burns. Burns Vol. 4, 44 - 45.
  31. M.H. Keswani. The treatment of Burns: First aid and transport of the burned patient with reference to Indian conditions. Burns Vol. 4, 46 - 48.
  32. S. Arora and N.H. Antia. Burns Vol. 4, 49 - 51. The treatment of Burns: Treatment of burns in a District Hospital.
  33. N. Rengabashyan: Burns Vol. 4, 52 - 54. The treatment of Burns: Early management of burns.
  34. N.H. Antia et al. Burns Vol. 4, 55 - 60. The treatment of burns immunological studies in Burns.

35. Z. Janzekovic. Burns Vol. 4, 61 - 66. The treatment of burns: Excision of burns.
36. Professor W.J. Rudowski. Burns Vol. 4, 67 - 71. The treatment of burns: summing up.
37. Lee E. Edstrom et al. Evaluation of Exercise techniques in burn patients.
38. Marjorie D. Head. Burns Vol. 4, 136 - 139. Paraffin and sustained stretching in the treatment of burns contractures.
39. M.A.P. Milling Burns Vol. 4, 145 - 146. Scalds from motor vehicle cooling systems.
40. Janos Novak et al. Burns Vol. 4, 197 - 206. Burns associated with mechanical injuries.
41. J.K. Sinha et al. Burns Vol, 261 - 266. Electrical burns. A review of 80 cases.
42. J. Moserova. Burns Vol. 3 International co-operation in the prevention of burn injuries.
43. Russe Pardoe et al: Phenol burns. Burns Vol. 3, 29 - 41.
44. Lorraine Rubis et al, Burns Vol. 3, 87 - 92. Management of burns of the perineum and buttocks.
45. S.K. Bhatnagar. Burns Vol. 3, 93 - 95. Burns: a complication of Epilepsy.
46. Phala A. Helm Burns Vol. 3, 123 - 125. Peripheral Neurological problems in the acute burn patient.

47. Bent Sorensen et al. Burns Vol. 3, 166 - 170.  
Coffee scalds - pursuant prophylaxis.
48. Andrew Yiacoumeths et al. Burns Vol. 3, 195 - 201.  
An analysis of burns in children.
49. Diane Holley et al. Burns Vol. 3, 215 - 217.  
Hyperextension deformity.
50. D. McG. Jackson. Burns Vol. 2, 90 - 106 Burns  
into joints.
51. Hiderjio O'ya. Burns Vol. 2, 115 - 121. Inhala-  
tion burn: statistical study of flame burned patients  
and deaths resulting from burns in Japan.
52. R. Konigova. Burns Vol. 2, The Ethical problems  
associated with treatment of severe burns.
53. J. Wilson Carswell. Burns Vol. 2, 178 - 183. A  
fire report. Management of the burned patient.
54. J. Wilson. Burns Vol. 2, 184 - 190. A fire at  
Nakivubo, Kampala a case report: Infection in a  
group of burned patients.
55. J. Wilson Burns Vol. 2, 191 - 198. A fire at  
Nakivubo Kampala - a case report: One year follow  
up of a group of burned patients.
56. A. Ward Gardner and Susan Foster. Burns Vol. 2,  
204 - 206, Teaching safety, accident prevention  
and first aid in Schools.
57. A.B. Wallace. Burns Vol. 1, 2 - 4. Lecture to the  
International Society for Burn injuries.

58. D. McG. Jackson. Burns Vol. 1, 70 - 74. The psychological effects of burns.
59. D.C. Larson et al. Burns Vol. 1, 119 - 127. Mechanism of hypertrophic scar and contracture formation in burns.
60. B. Moores and M.M. Rahman. Burns Vol. 1, 135 - 141. Discriminant function analysis of 570 consecutive burns patients admitted to the Yorkshire Regional Burns Centre between 1966 and 1973.
61. Helen L. Martini. A method of enquiry into the experience of children with burns and scalds. Burns Vol. 1, 142 - 144.
62. Kaakabab Karim et al. Burns factors of burn injuries in children.
63. L.C.Y. Ho et al. Burns Vol. 1, 149 - 159. Extensive deep neck burns.
64. William W. Monato and Corey Bohling. Burns Vol. 1 172 - 174. Keratoacanthoma arising in newly healed burn scars.
65. Irena Monies Chass et al. Burns Vol. 1, 309 - 313. Early Management of severe burns.
66. E. Julia Keogh. Burns Vol. 1, 314 - 316.
67. R. Rodriguez Valdes et al. Burns Vol. 1, 317 - 318. Electric Cataract.
68. Douglas Jackson. Burns Vol. 1, Burns of bones. Can these bones live I. Historical view and aetiology.

69. Douglas Jackson. Burns Vol. 1, 356 - 372. Burns of bone: Can this bone live? Results of 98 cases and discussion of treatment.
70. G.C. Ramsay. Burns Vol. 5, 315 - 320. Fire tests and hazards: an Australian approach.
71. B. de Wet et al. Some aspects post treatment adjustment in severely burned children. Burns Vol. 5, 321 - 325.
72. S.P. Pegg et al. Epidemiological of adult burn injuries. Burns Vol. 5, 343 - 348.
73. Elizabeth L. Ward et al. Burns Vol. 5, 343 - 348. Epidemiology of burn injuries in a rural community.
74. L.F.A. Koss. Burns Vol. 5, 344 - 352. Bandage burns: the fire risk of cotton wool; two case reports.