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**Neha Jain**

Department of Plastic Surgery  
and Burns. Bai Jerbai Wadia  
Hospital for Children, Mumbai,  
India.

**Chethan G.S. Kumar**

Department of Plastic Surgery  
and Burns. Bai Jerbai Wadia  
Hospital for Children, Mumbai,  
India.

**Jovita M. Saldanha**

Department of Plastic Surgery  
and Burns. Bai Jerbai Wadia  
Hospital for Children, Mumbai,  
India.

**Shankar Srinivasan**

Department of Plastic Surgery  
and Burns. Bai Jerbai Wadia  
Hospital for Children, Mumbai,  
India.

**Suhas Abhyankar**

Department of Plastic Surgery  
and Burns. Bai Jerbai Wadia  
Hospital for Children, Mumbai,  
India.

**Arvind M.Vartak**

Department of Plastic Surgery  
and Burns. Bai Jerbai Wadia  
Hospital for Children, Mumbai,  
India

**Minnie Bodhanwala**

Chief Executive Officer, Bai  
Jerbai Wadia Hospital for  
Children, Mumbai, India.

**Correspondence:**

**Jovita M. Saldanha**

Department of Plastic Surgery  
and Burns. Bai Jerbai Wadia  
Hospital for Children, Mumbai,  
India.

## An Epidemiological Study of Burns in Pediatric Age Group: Our Experience at B.J. Wadia Hospital for Children.

**Neha Jain, Chethan G.S. Kumar, Jovita M. Saldanha, Shankar Srinivasan, Suhas Abhyankar, Arvind M.Vartak, Minnie Bodhanwala**

### Abstract

Burns is the 2<sup>nd</sup> largest group of injuries after road accidents. It is the most severe type of injuries with high mortality & morbidity rate. The burn scenario is grave not only due to the high incidence but is also compounded by absence of organized burn care at primary and secondary health care level. Absence of stringent law regarding environmental safety, substandard manufacturing of household electric and cooking equipments and general lack of safety consciousness fail to curb this preventable menace. In addition, all statistical figures are approximate figures as there is no national data on burns and a central registry is nonexistent.

Our study aims to report the actual figures and the scenario in our institution. It was observed that major accidents occur with scalds in the morning at home. Major share of the burns is amongst 1-to-5-year age group.

It was also noted that awareness on first aid is getting better with time.

Our mortality rate & duration of hospital stay has reduced due to good medical care, better fluid management, emphasis on nutrition such protein rich Butter Milk diet given to our patients and better antibiotics management.

There is a lot of scope to prevent burns injury. We can also work towards reducing the morbidity & mortality related to burns in our country. Focus on awareness programmes based on an updated Burn data registry and better medical management can definitely improve the scenario of burn injuries in our country.

**Keywords:** burns, pediatrics, mangement, registry

### Introduction

Burn injuries rank amongst the most severe types of injuries suffered by the human body with a high mortality and morbidity rate<sup>1</sup>. India, the second most populous country in the world with over a billion people, has an estimated annual burn incidence of 6-7 million, based on data from major hospitals when extrapolated to the whole country, which is the second largest group of injuries after road accidents. Nearly 10% are life threatening and require hospitalization. Approximately 50% of those hospitalized succumb to their injuries. Nearly 1 to 1.5 lakh people get crippled and require multiple surgeries and prolonged rehabilitation. Seventy percent of the burn victims are in most productive age group of 15 to 40 years and most of the patients belong to a poor socioeconomic stratum. Burns is not a notifiable disease and our country does not have a central burns registry, hence data on burn injury is sparse<sup>2</sup>.

National Academy of Burns India (NABI) states that, around four out of five burn cases are women and children. Children have often been exposed because of their greater vulnerability to accidents owing to their inability to recognize and evaluate hazardous situations<sup>3</sup>.

Paediatric burns constitute a substantial proportion (16.6%) of total burn admissions. According to World Health Organisation (WHO), burns are the 11<sup>th</sup> leading cause of death of children aged between 1 and 9 years and are also the fifth most common cause of non-fatal childhood injuries. While a major risk is improper adult supervision, a considerable number

of burn injuries in children result from maltreatment<sup>4</sup>. High mortality, long term rehabilitation, cosmetic disfigurement, pain and trauma of dressing, hospitalisation and emotional adjustments in an immature child add to the tragedy, initially for the parents and later for the victims<sup>5, 6</sup>.

The burn scenario is grave not only due to the high incidence but is also compounded by the absence of organized burn care at primary and secondary health care level. The silver lining to this grim situation is that, 90% of all burn injuries are preventable. However, absence of stringent law regarding environmental safety, substandard manufacturing of household electric and cooking equipments and general lack of safety consciousness fail to curb this preventable menace.

**Materials and Methods**

A study was conducted on burn patients younger than 18 years who were admitted between January 2009 and December 2019 at the burn’s unit at B.J. Wadia hospital, Parel. It is a regional referral centre for all pediatric burn injuries. Data was obtained using a pre-designed and pre-tested questionnaire about age, sex, burn size, depth of injuries and etiology of burns in all cases on arrival to our department. Medical records were reviewed retrospectively and epidemiological data including age, sex, seasonal variation, number of members in the family, economic status, type and place of burn, period between the accident and admission to hospital stay, total body surface area (TBSA) involved, first aid and mortality were evaluated and tabulated.

**Management Protocol**

All patients were managed strictly by a formulated department protocol. As soon as the patient arrives to the casualty, attending doctor estimates the percentage the burn surface (TBSA) after taking the weight of the child.

Patients with partial thickness burns greater than 10% of TBSA, partial thickness burns over more than 5% of TBSA in patients less than 3 years, any burn in neonates, electrical burns, chemical burns and burns involving face, hands, feet, genitalia, perineum or major joints were admitted.

Intravenous fluid resuscitation with Ringers Lactate solution was given to patients with more than 10% burn surface area by the formula: Fluid requirement (ml/hr) = weight of child X TBSA/4. Fluid infusion was adjusted as per the urine output so as to maintain an output of 1-2cc/kg/hr. Urinary catheterisation and Ryle’s tube insertion was done immediately. Prophylactic antibiotics were avoided in most cases unless patient reached the hospital in an unstable condition. Tube feeding with clear liquids followed by high protein butter milk diet was commenced as soon as bowel sounds appeared and gradually over a period of 72 hours, intravenous infusion was stopped. Butter milk diet is a cheap, high calorie, high protein diet given to all burn patients. It comprises of 250grams curd, 1 banana, 1 raw egg and 2 tablespoons sugar blended and freshly prepared daily.

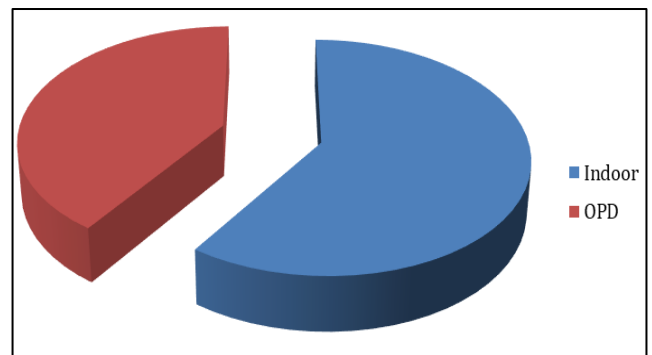
Daily bath and dressings were done in sterile conditions in a dedicated burns dressing room maintained for burn dressings only. Dressing was done with under pad sheets coated with silver sulphadiazine cream. Under pad, commonly available as Tena bed, comprises of 3 layers; an inner covering that is a non-adhesive filtrated bonded sheet, absorbent wadding made up of cellulose pulp and polymers

and an outer water-proof covering that forms a barrier to liquids. It retains wound moisture and is non- adherent which makes change of dressing painless and less traumatic for the patient (7).

Monitoring of the patient involved detailed daily clinical examination & evaluation of vital parameters. Haematological and biochemical investigations were done twice a week. As per the transfusion protocols of our unit, packed cell transfusions were given in case of anaemia and fresh frozen plasma and albumin transfusion were given in case of hypoproteinemia. Wounds swabs were taken on admission and thereafter twice a week to check for culture sensitivity against all class of antibiotics. Antibiotics were administered only if the patient showed clinical signs of infection, based on the sensitivity reports.

**Results**

In our study, 830 patients were seen in our hospital over a period of 10 years. 495 patients required admission and 335 were managed on outpatient basis (Fig 01).



**Fig. 1:** 830 patients were seen in our hospital over a period of 10 years. 495 patients required admission and 335 were managed on outpatient basis.

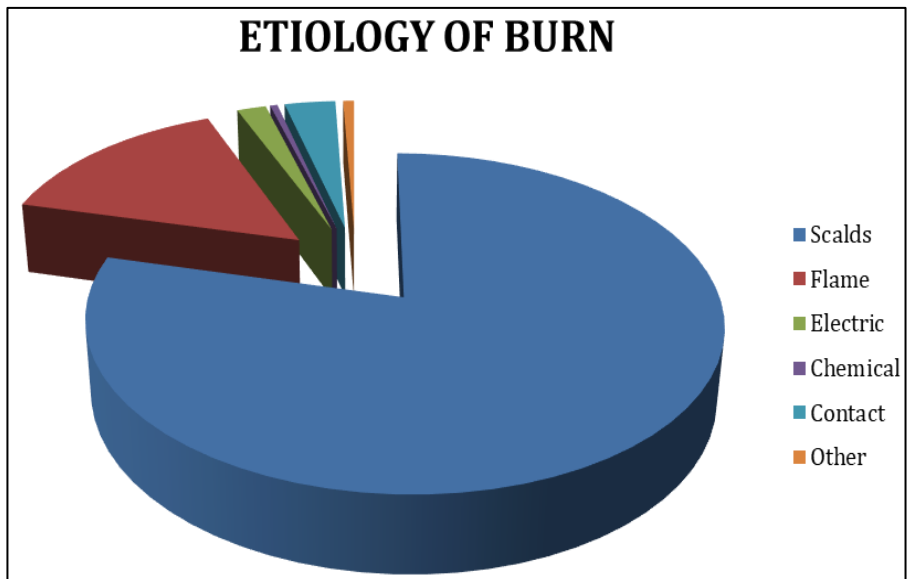
Majority patients belonged to the age group 1-5 years, male to female ratio was 1.2: 1 (Table 01).

**Table 1:** Distribution of cases with respect to age and sex.

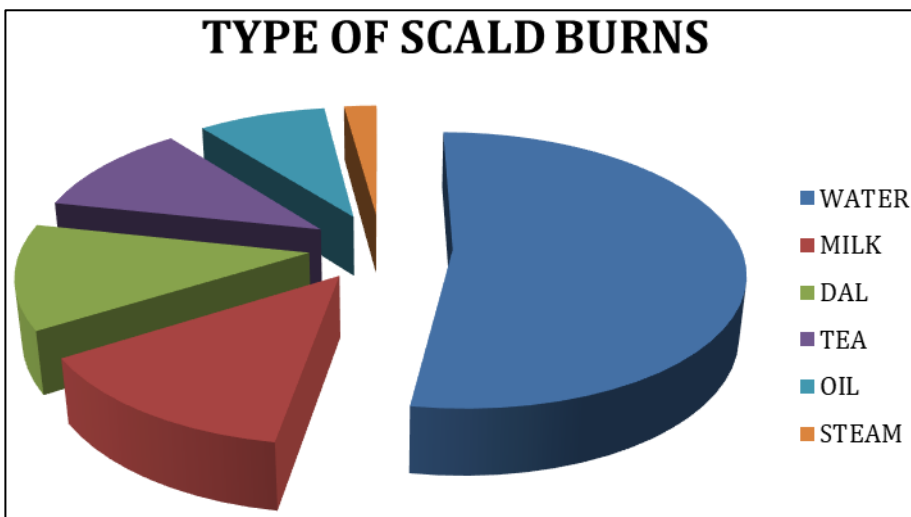
Age group	male	female	total	percentage
neonate	2	2	4	0.48
<1 year	46	36	82	9.88
1-5 years	315	262	577	69.52
6-10 years	71	47	118	14.22
11-15 years	28	20	48	5.78
16-18 years	1	0	1	0.12
Total	463	367	830	100

Maximum patients were seen during winter and festival season in October and November months and comparatively a smaller number of patients were seen in summer and rainy seasons.

Scalds were the most common cause of burns in 652 patients (78.55%), followed by flame burns in 134 (16.14%) patients. Other important causes included contact burns in 27 and electric burns in 16 children. Various causes of scald injuries were (343) 52.6% hot water, (88) hot milk, (80) hot dal, (72) hot tea, (55) hot oil and (14) steam. All except one were accidental burns. We came across 1 patient with suicidal history of burn (figure 02 & 03).



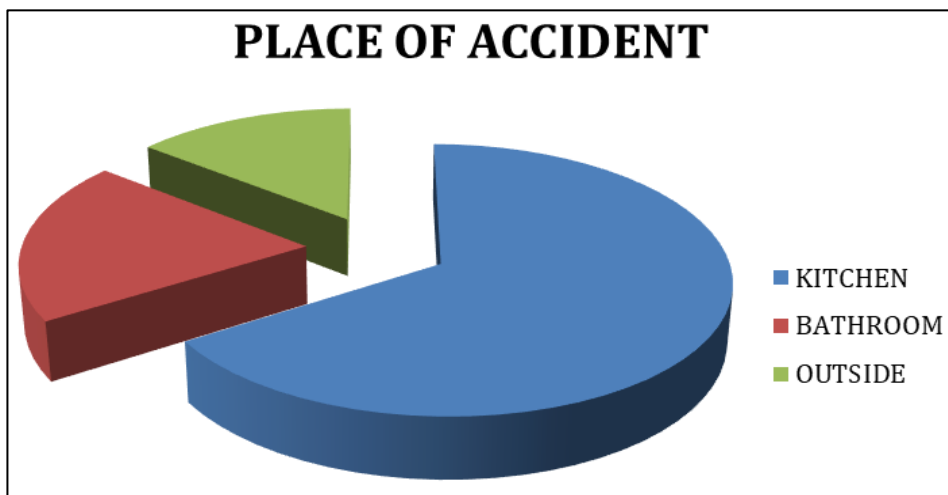
**Fig. 2:** Scalds were the most common cause of burns seen in 652 (78.55%) patients followed by flame burns which were seen in 134 (16.14%) patients. Other important causes included contact burns in 27 and electric burns in 16 children.



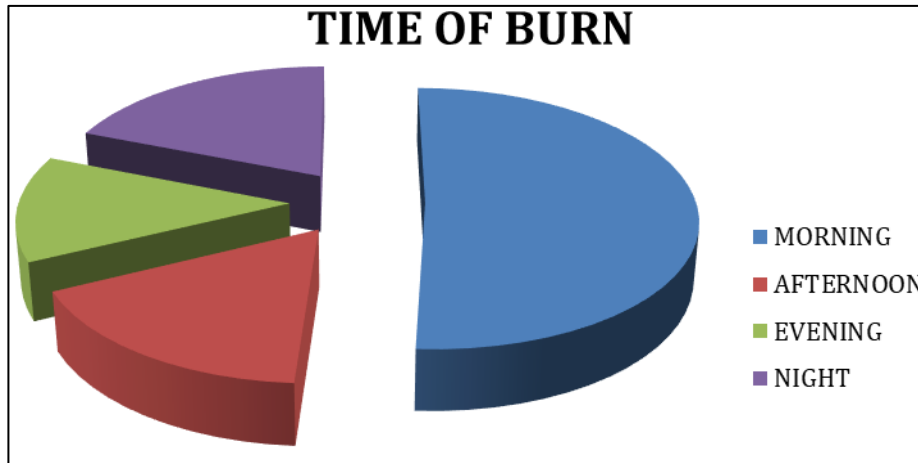
**Fig. 3:** Various causes of scald injuries were 343(40%) hot waters; (88) hot milk, (80) hot dal, (72) hot tea, (55) hot oil and (14) steam.

Majority of burn injuries were domestic in nature. Out of 712 cases, 547 cases happened in the kitchen and 165 in the bathroom. 118 cases occurred outside the house. Majority incidents (50.96%) happened in the morning hours of the

day. Most of the patients belonged to lower middle and low socio-economic strata and were members of medium or large size families (Fig 04,05).



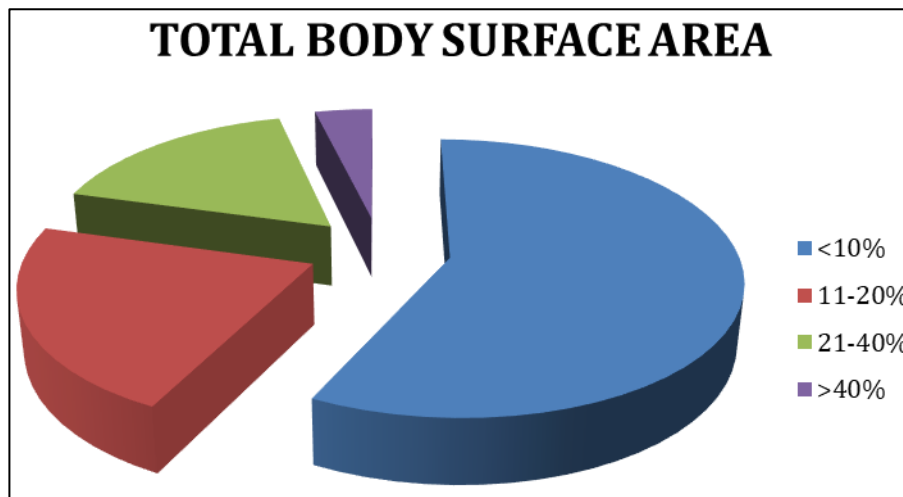
**Fig. 4:** Majority of burn injuries were domestic injuries i.e., 712 cases of which 547 happened in kitchen and 165 in bathroom. 118 cases happened outside.



**Fig. 5:** Majority incidents (51%) happened in the morning hours of the day.

The majority of patients, 499(60%) children, sustained burns below 10% BSA, 191(23%) were 11-20%BSA, 147(17.71%) 21-40 and less than 4% were > 40% BSA.

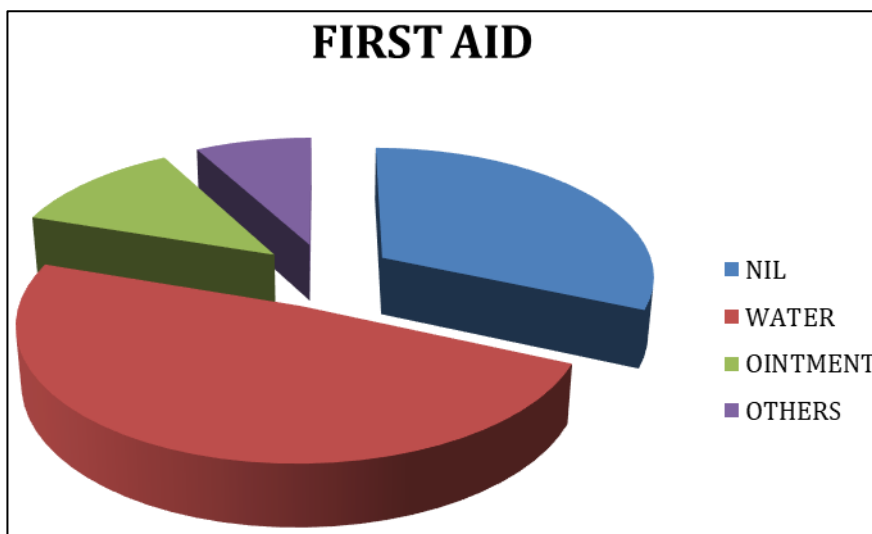
Maximum TBSA was 85-90% and minimum 0.5% (Fig 06).



**Fig. 6:** The majority of patients, 499(60%) children, sustained burns below 10% TBSA, 191(23%) were 11-20%BSA, 147(17%) 21-40% TBSA and Only 33(4%) sustained > 40% BSA. Maximum TBSA was 85-90% and minimum 0.5%.

In terms of first aid, water was poured over the burn area in 68% of the cases. The 403 patients received water followed by 99 patients had various ointments applied and remaining

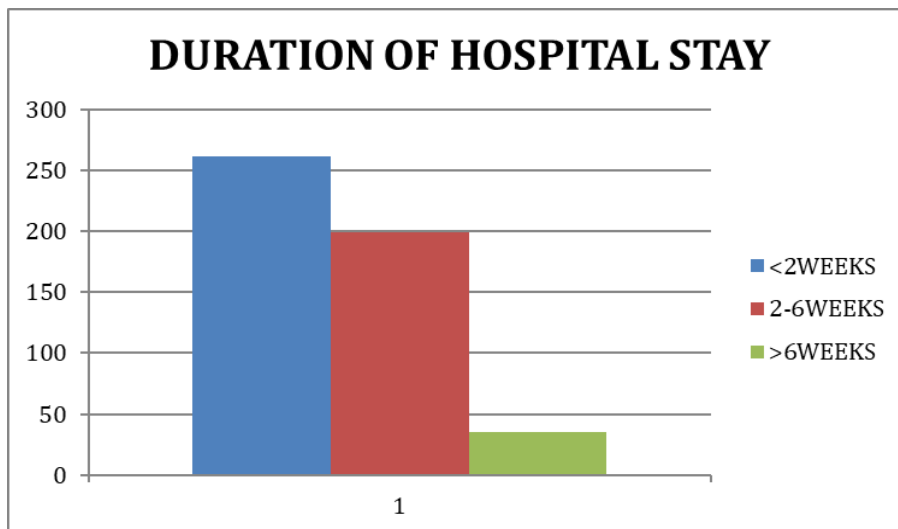
66 patients received other measures like toothpaste, ice, oil and blanket. 32% patients did not receive any first aid (Fig 07).



**Fig. 7:** 68% patients received first aid, 403 patients received water and 99 patients received ointment as first aid. 66 patients received other measures like toothpaste, ice, oil and blanket. 32% did not receive any first aid.

Overall mortality was 3.1%. Majority of patients that succumbed were 1- 2 years old. Majority of deaths occurred in patients with >40 % TBSA involvement. Highest mortality was seen within 2-5 days post-burn injury. Flame burn on an average had a higher incidence of mortality 10.6% as compared to scalds, which was 2.3%. Out of 495 patients that were admitted, 261 were discharged within 10-14 days. Increased hospital stay was seen in the

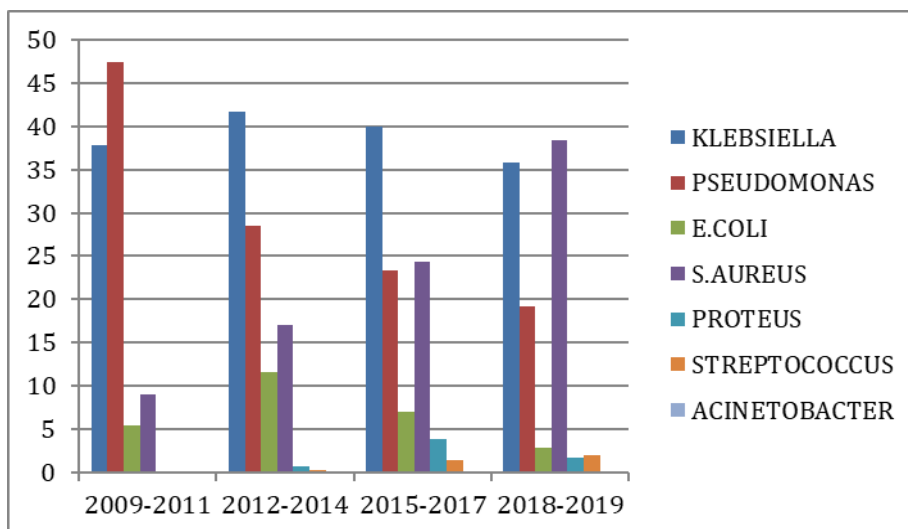
group of patients with deep burns requiring skin grafting in multiple sessions. In all, 98 patients required skin grafting for wound closure. Out of 495 admitted patients, 261 were discharged within 2 weeks, 199 patients in 2-6 weeks and remaining 35 stayed for over 6 weeks as they required multiple sessions of split skin grafting to cover large wound areas (Fig 08).



**Fig. 8:** Out of 495 patients that were admitted, 261 were discharged within 2 weeks, 199 patients discharged in 2-6 weeks and remaining 35 took >6 weeks as they required multiple sessions of split skin grafting to cover large wound areas.

Table 02 & figure 09 gives us a picture of changing microorganisms on burn wounds. From 2009 to 2011, Pseudomonas was found to be the predominant organism (47.41%) from 2009 to 2011. Further on, Klebsiella

predominated the group of microorganisms from 2012 to 2017 with an average of 40.82%. In 2018 & 2019 staphylococcus outnumbered the gram-negative organisms at 38.40%.



**Fig. 9:** Bacteriological Data (2009-2019).

**Table 2:** Bacteriology Data (2009-2019).

Year	2009-2011	2012-2014	2015-2017	2018-2019
Total Isolates	1428	736	566	349
Organisms	%	%	%	%
Klebsiella	37.75	41.71	39.93	35.82
Pseudomonas	47.41	28.53	23.32	19.20
E-coli	5.46	11.55	7.07	2.87
Proteus	0.21	0.68	3.89	1.72
S. aureus	9.03	17.12	24.38	38.40
Acinetobacter	0.07	0.18	0.0	0.0
Strptococcus	0.07	0.27	1.41	2.01

## Discussion

More than one million people in India, sustain moderate to severe burn injury each year, as stated in the Annual report by the Ministry of health and Family welfare (8,9). This is significantly lower than the 7 million estimated in a study by researchers at Cambridge University, Harvard & John Hopkins University (10). The Indian Burn care management suffers from lack of data. Burn injuries are highly preventable injuries and the incidence can be brought down considerably if data is properly reported & awareness on prevention of burn injury through mass education programs is conducted. Identification of populations at risk and description of structural determinants from correct data sources are urgently required so that interventions can be rapidly implemented.

Our study aims at reporting the data analysed at our institution that caters to one of the most vulnerable populations of society.

At our institution, majority of the patients admitted belonged to the age group of 1-5 years. This is similar to the results obtained in study conducted by Mukerji G & Sharma et al. (5,11) The higher incidence of burns in this age group could be due to the inquisitive & curious nature of younger children and lack of awareness of hazardous situations.

It has been indicated that prevalence of male burn victims is higher than females in many studies (5,11,12,13). The likely reason stated was that males are generally more active than females and have higher probability of exposure to risk factors (14). There was a difference seen in our data but it was not very significant. Male to female ratio in our centre was 1.2:1. This ratio may get insignificant with time.

Eighty eight percent of the accidents occur at home. This is similar to the incidence shown in the study by Mukerji G et al. (5) Majority of the incidents occur in the morning when there is maximum activity in the houses. A rush in the mornings to get out of the house for work & school is one of the major factors. In the mornings, kitchen & bathroom sees a lot of activity in Indian homes due to cooking & bathing.

Scalds is the most common cause of burns in children accounting for 79% of total burn injuries. (11,13) Low socio-economic level is an important factor in burn injury. Most of our patients came from low-income groups which was similar to other studies. (11) They live in smaller homes; kitchens are not separated from the living area. Most of the cooking activities take place on the floor of a small room where vessels containing hot liquids are kept at ground level and children while exploring new things accidentally fall on these containers or put their hands into it. Another factor could be that grandparents look after children who may have age related physical decline or disabilities making it difficult to prevent untoward incidences.

Most of the burns occurs between October to January. (5) Our data reiterates the same. During these months, India celebrates festivals like Diwali which is a festival of lights and there is an increased use of fire crackers. The other reason is that the season of winter sets in after October till late January due to which there is an increase in the usage of hot water and consumption of hot liquids. Rural areas experience colder climate than the urban cities. People burn a lot of wood to generate heat. All these heat generating activities may be the reason for increase in burn injuries during this time of the year in India.

It was noted that knowledge about 1<sup>st</sup> aid is getting better with time. More than 65% people use some kind of first aid.

The mortality rate of our study was 3.8% which was considerably low as compared to the study conducted by Sharma et al (11) showing 13.8% and Mukerji G et al that reported 21.8%.

The average hospital stay was found to be less than 14 days in majority of our cases.

The microorganisms that dominate the burn wounds at our unit are Pseudomonas, Klebsiella & Staphylococcus. Our unit administers antibiotics based on the weekly culture sensitivity reports. This helps to prevent septicaemia and complications related to burn wound infection to a great extent.

Credit of a lower mortality rate and hospital stay must be given to our treatment method which differs from other centres. A standard treatment protocol that focuses in fluid resuscitation, burn wound infection & most importantly on the diet of the burn patients has definitely helped us achieve a good outcome in burn wound care. Details on our treatment protocol are mentioned under Materials & Methods - Management protocol.

## Conclusion

There is a significant occurrence of pediatric burns in the society. Home is the major place of burn among the children. Kitchen and bathroom being amongst the main places of the accidents at home. Majority of burns takes place in morning when there is hurry and relative neglect of working parents due to their work schedules.

Major cause of burn is scald followed by flame. Among scalds, the major cause was found to be hot water used for bathing. Hence, we need to be more cautious with children in and around bathrooms, water heating devices, vessels containing hot water etc., especially in early hours of the day.

Being careful in kitchens and being more careful with children during rush hours should be highlighted & emphasised by government while creating awareness programs for prevention of burn injuries.

Many people now have a better knowledge of first aid. This shows that awareness on first aid is getting better with time.

Major share of burns is amongst 1-to-5-year age group. Hence guidelines need to be formed targeting this age group population.

Mortality at our unit is considerably low & majority of indoor patients are discharged within 2 weeks. This is due to a better burn wound management protocol at our centre. Appropriate medical care, better fluid management, emphasis on protein rich nutrition and better antibiotics management that is based on clinical condition & regular wound monitoring with the help of antibiotic sensitivity reports are the key factors of our treatment protocol.

Though, majority of burns are < 10%, there is a major loss of finances, human resources and working hours of parents and other concerned personnel.

There is a lot of scope to prevent burn injuries in our country. We must also work together towards reducing the morbidity & mortality related to burn injury. Focus on improving burn treatment protocols, having an updated burn data registry and using this data to curb the major factors that cause burn injuries must be our priority.

Governments should organise more awareness camps & better medical care facilities in rural area to improve the scenario in villages. If these steps are taken promptly, then very soon we will manage to reduce burn Injuries & their related issues in our country.

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