

## Domestic burns among children, adolescents and young adults: urgency and emergency cases

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### ABSTRACT

The objective of this study was to analyze domestic burns caused by the exposure to electric current/radiation/temperature, smoke/fire/flames and contact with a source of heat/hot substances, in children, adolescents and young adults treated at an urgency/emergency service of reference. A descriptive, cross-sectional study was conducted with victims (0 to 24 years of age) of home burns treated at an urgency/emergency service of a capital city located in the center-west region of Brazil, in 2013. In total, 84 victims of home burns were studied, with prevalence of female victims (59.5%) and age group of 1-4 years of age (27.4%). The most frequent burns were caused by contact with a source of heat/hot substances (82.1%) and exposure to smoke/fire/flames (15.5%). The body areas most commonly affected by home burns were head, trunk, and upper and lower limbs (90.5%), with prevalence of second-degree burns (40.5%). Home burns significantly affect children, adolescents and young adults, particularly female subjects, highlighting the importance of providing preventive and educational activities to female victims.

**Descriptors:** Accidents, Home; Burns; Electric Injuries; Emergency Medical Services; Nursing Care.

### INTRODUCTION

Among external causes, home burns are among the main causes of morbimortality in Brazil and worldwide, mainly affecting children, adolescents and young adults, being one of the main accidental reasons in emergency services<sup>(1-6)</sup>. However, the World Health Organization (WHO) highlights a higher frequency of

burn injuries in underdeveloped countries when compared to developed countries, and one of the aspects indicating this difference refers to the prevention policy implemented by the government and adopted for the population<sup>(1)</sup>.

Recent data from the Ministry of Health show that in Brazil, from June 2013 to June 2014, 43,660 hospitalizations were reported among the population of 0-24 years of age due to exposure to electricity, radiation, high temperatures and pressures (Codes W85-W99 of the International Classification of Diseases ICD10), exposure to smoke, fire and flame (Codes X00-X09) and contact with a source of heat and hot substances (Codes X10-X19)<sup>(7)</sup>. The cost of these hospitalizations represented the amount of R\$ 43,949,425.25<sup>(7)</sup> to public coffers. Regarding mortality, in the same age group, in the same period, for the same group of causes, the rate was 1.01 death per 1,000 inhabitants, higher than in the group of people of less than one year old (rate: 1.87/1,000 inhabitants)<sup>(7)</sup>.

For health services, the costs related to nursing care and treatment of home burn are high and represent a public health problem due to hospitalization and treatment time<sup>(7-9)</sup>. Besides the financial impact, burns have physical and emotional consequences for the victims and their families, which are difficult to measure<sup>(10)</sup>.

Burn is an epithelial tissue injury caused by heat from different sources (hot substances, chemicals, electricity, direct flame or heated objects), and it is classified according to the epithelial injury depth, as: first-degree burn (reaches the epidermis), second-degree burn (reaches the epidermis and dermis) and third-degree burn (destroys all skin layers and may reach subcutaneous tissues, muscles and bones)<sup>(11)</sup>.

Therefore, the type of injury caused by burn determines a physical and emotional trauma of high impact to the victim, especially due to the pain it generates and extended treatment<sup>(4)</sup>. Combined with physical suffering and emotional distress at the moment of the accident, the victim often has lifetime sequelae, especially children and adolescents. Such sequelae cause physical deformity on the face and body, functional disability (especially when it involves the limbs), and neurological and psychosocial disorders due to accident trauma<sup>(12)</sup>.

Investigations on home burn characteristics among children, adolescents and young adults are relevant, once they can be prevented and direct nursing actions towards the development of health policies for home burn prevention, nursing care and treatment for this population group.

Thus, the objective of this study was to analyze the characteristics of domestic burns caused by exposure to electric current/radiation/temperature, smoke/fire/flames and contact with a source of heat/hot substances, which have, as victims, children, adolescents and young adults treated by an urgency/emergency service of reference.

## METHODS

A descriptive cross-sectional study, with retrospective data collection and quantitative analysis was conducted. The study population comprised victims of home burns (from zero to 24 years of age), treated at

a municipal hospital (HPSMC) of a capital located in the center-west region of Brazil in 2013.

The accident classification was based on the 10th revision of the International Classification of Diseases (ICD-10); which allows the comparison of findings to other studies and better defines the types of accidents as it is an international classification. This study included accidents caused by home burns due to exposure to electric current, radiation and temperature (W85-W99), exposure to smoke, fire and flames (X00-X09), and contact with a source of heat and hot substances (X10-X19), and it excluded accidents caused by intentional burns and burns of undetermined causes and locations.

For data collection, a pre-tested form was used, with 25 closed-ended questions and one open-ended question asking for a description of the accident that caused the burn. The source of data was the emergency service records from nursing care provided for the period of one year (January 1 to December 31, 2013). Data were collected from the hospital's files by two properly trained researchers in the period of three months (January to March 2014).

The studied variables were: victim profile (gender, age group, municipality of residence), accident profile (accident type and circumstances, time/week day/month the accident happened); nursing care profile (place of first care, time elapsed between the accident and health center care, person who brought the victim to the health center); accident consequences (affected body region, burn degree/depth, immediate physical sequela); and clinical progress of victim (referral, discharge from emergency care, immediate hospitalization and death).

Data were processed by a statistical software, and descriptive and inferential statistics were used for the analysis, through simple and bivariate analyses (chi-square test, with results considered statistically significant when p was equal to or lower than 0.05).

This study was approved by the Research Ethics Committee of the University Hospital Júlio Muller, on September 25, 2013, under protocol 405.578, respecting all ethical principles in effect in the Brazilian legislation.

## RESULTS

The Emergency Municipal Hospital of Cuiabá (Hospital Pronto Socorro Municipal de Cuiabá - HPSMC) provided emergency care to 84 people due to home burn during the studied year.

More than half the victims were female (50-59.5%), and male victims totaled 40.5% (34). Among the female patients, a higher frequency of home burns was reported in the age group of one to four years of age (28.0%), 20 to 24 years (18.0%) and 10 to 14 years (16.0%), whereas among male patients, the prevalence was among 10 to 14 years of age (29.4%), one to four years (26.5%) and five to nine years (23.5%) (Table 1). Regarding the location of victims, only 19 (22.6%) lived in other municipalities, and 65 (77.4%) were from Cuiabá, Mato Grosso, Brazil.

**Table 1:** Distribution of home burns in the group of 0 to 24 years of age, treated at the Emergency Municipal Hospital of Cuiabá, according to victims' gender and age (p=0.3256). Cuiabá, Mato Grosso, Brazil, 2013.

Age group	Gender					
	Female		Male		Total	
	Nº.	%	Nº.	%	Nº.	%
< 1 year	5	10	1	2.9	6	7.1
1 to 4 years of age	14	28	9	26.5	23	27.4
5 to 9 years of age	7	14	8	23.5	15	17.9
10 to 14 years	8	16	10	29.4	18	21.4
15 to 19 years	7	14	3	8.8	10	11.9
20 to 24 years	9	18	3	8.8	12	14.3
<b>Total</b>	<b>50</b>	<b>100</b>	<b>34</b>	<b>100</b>	<b>84</b>	<b>100</b>

The most frequent home burns were caused by contact with a source of heat/hot substances (82.1%) and exposure to smoke/fire/flammes (15.5%) (Table 2). Among home burns due to source of heat and hot substances, the prevalent causes were contact with hot drinks, foods, fats and cooking oils (40.5%) and scalding (25%). Among home burns due to smoke/fire/flammes, the prevalent causes were ignition of alcohol, kitchen gas and gasoline (8.3%), followed by oven fire caused by cigarette spark (3.6%).

**Table 2:** Distribution of home burns in the group of 0 to 24 years of age, treated at the Emergency Municipal Hospital of Cuiabá, according to the type of burn and body region affected/injury. Cuiabá, Mato Grosso, Brazil, 2013.

ICD-10 Code	Type of burn	Nº.	%
W85-W99	Exposure to electric current, radiation and extreme ambient air temperature and pressure	2	2.4
W86	Victim of electric shock due to exposure to electrical wiring	1	1.2
W87	Exposure to unspecified electric current	1	1.2
X00-X09	Exposure to smoke, fire and flames	13	15.5
X04	Exposure to ignition of highly flammable material (alcohol/kitchen gas/gasoline)	7	8.3
X08	Exposure to other specified smoke, fire and flames (oven fire caused by cigarette spark)	3	3.6
X09	Exposure to unspecified smoke, fire and flames	3	3.6
X10-X19	Contact with a source of heat/hot substances	69	82.1
X10	Contact with hot drinks, foods, fats and cooking oils	34	40.5
X12	Contact with other hot fluids (scalding)	21	25.0
X13	Contact with steam and other hot vapors	2	2.4
X15	Contact with hot household appliances	5	6.0
X17	Contact with hot engines, machinery and tools	1	1.2
X19	Contact with other heat and hot substances	6	7.1
	<b>Total</b>	<b>84</b>	<b>100.0</b>

Table 3 shows a cross-check between the type of burn and victim age (p value did not present statistical significance), and indicates that the most frequent burns in victims less than one year old were due to contact with hot drinks/foods/fats/cooking oils (33.2%). Among children of one to four years of age, the highest frequency of burns was due to scalding (39.1%). Children above five years of age also presented a high proportion of burns caused by hot drinks/foods/fats/cooking oils. Burns due to exposure to ignition of highly flammable substances was more frequent in the population of 20 to 24 years old (25.0%).

**Table 3:** Distribution of home burns in the group of 0 to 24 years of age, treated at the Emergency Municipal Hospital of Cuiabá, according to the type of burn and victim age. Cuiabá, Mato Grosso, Brazil, 2013. (p=0.0789)

Type of burn*	Age group (in years) (%)						Total
	<1	1-4	5-7	8-14	15-19	20-24	
W86	-	-	-	-	10	-	1.2
W87	-	-	-	-	-	8.3	1.2
X04	16.7	4.4	6.7	-	10	25	8.3
X08	-	4.4	-	-	10	8.3	3.6
X09	-	4.4	-	5.6	10	-	3.6
X10	33.2	21.7	73.3	50	20	41.8	40.5
X12	16.7	39.1	13.3	33.2	20	8.3	25
X13	-	-	-	-	10	8.3	2.4
X15	16.7	13	-	5.6	-	-	6
X17	16.7	-	-	-	-	-	1.2
X19	-	13	6.7	5.6	10	-	7
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

\* Legends:

- W86: Victim of electric shock due to contact with an electric outlet
- W87: Exposure to unspecified electric current
- X04: Exposure to ignition of highly flammable material (alcohol 5, kitchen gas 1, gasoline 1)
- X08: Exposure to other specified smoke, fire and flames (oven fire 2, cigarette spark 1)
- X09: Exposure to unspecified smoke, fire and flames
- X10: Contact with hot drinks, foods, fats and cooking oils
- X12: Contact with other hot fluids (scalding)
- X13: Contact with steam and other hot vapors
- X15: Contact with hot household appliances
- X17: Contact with hot engines, machinery and tools
- X19: Contact with other heat and hot substances

The information regarding the time of accident was not provided in almost all emergency care recordings (77-91.7%), and when present, it showed three accidents in the morning (6am-12pm) (3.6%), two in the afternoon (1pm-6pm) (2.4%), one at night (7pm-11pm) (1.2%) and one during late night (12am-6am) (1.2%).

Regarding the day of week when the burn happened, the following frequency was reported: Wednesday (20-23.8%), Friday (10-22.6%), Monday (16-19.0%), Thursday (10-11.9%), Saturday (8-9.5%), Sunday (6-7.1%), Tuesday (5-6.0%).

The months with more burns were January (17-20.2%) and June (16-19.0%), followed by March (12-14.3%), April (12-14.3%), February (11-13.1%), May (10-11.9%), August (2-2.4%), July (1-1.2%), October (1-1.2%), November (1-1.2%) and December (1-1.2%). When analyzing the type of burn according to the month of occurrence (Table 4), the main burns of January were due to contact with hot drinks, foods, fats and cooking oils (47.1%) and contact with other hot fluids (scalding) (17.6%), while in June, most burns were due to contact with hot drinks, foods, fats and cooking oils (62.5%) and contact with hot household appliances (18.8%).

**Table 4:** Distribution of home burns in the group of 0 to 24 years of age, treated at the Emergency Municipal Hospital of Cuiabá, according to the type of burn (ICD-10) and month of occurrence. Cuiabá, Mato Grosso, Brazil, 2013. (p=0.0000)

Type of burn*	Month (%)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Nov	Oct	Dec	
W86	-	-	8.3	-	-	-	-	-	-	-	-	-
W87	-	-	-	-	-	-	100	-	-	-	-	-
X04	11.8	9.1	25	-	-	6.3	-	-	-	-	-	-
X08	-	9.1	-	8.3	10	-	-	-	-	-	-	-
X09	5.9	-	8.3	-	-	6.3	-	-	-	-	-	-
X10	47.1	18.2	16.7	41.7	30	62.5	-	100	100	100	-	-
X12	17.6	36.4	33.3	41.7	50	-	-	-	-	-	-	-
X13	-	-	-	-	10	-	-	-	-	-	-	100
X15	-	9.1	-	8.3	-	18.8	-	-	-	-	-	-
X17	-	-	-	-	-	6.3	-	-	-	-	-	-
X19	17.6	18.2	8.3	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>100</b>											

\* Legends:

- W86: Victim of electric shock due to contact with an electric outlet
- W87: Exposure to unspecified electric current
- X04: Exposure to ignition of highly flammable material (alcohol 5, kitchen gas 1, gasoline 1)
- X08: Exposure to other specified smoke, fire and flames (oven fire 2, cigarette spark 1)
- X09: Exposure to unspecified smoke, fire and flames
- X10: Contact with hot drinks, foods, fats and cooking oils
- X12: Contact with other hot fluids (scalding)
- X13: Contact with steam and other hot vapors
- X15: Contact with hot household appliances
- X17: Contact with hot engines, machinery and tools
- X19: Contact with other heat and hot substances

The health service analysis showed that, in all accidents with burns, the first nursing care was provided in a health center, most of them at the Emergency Municipal Hospital of Cuiabá (73.8%) (Table 5). It was not possible to determine the time elapsed between the accident and the nursing care because the nursing care records had no accident time reported. In more than half of the burns, the victim was brought by his/her mother to the hospital (57.1%) (Table 5).

**Table 5:** Distribution of home burns in the group of 0 to 24 years of age, treated at the Emergency Municipal Hospital of Cuiabá, according to the nursing care profile. Cuiabá, Mato Grosso, Brazil, 2013.

<b>Who provided the first nursing care</b>	<b>Nº.</b>	<b>%</b>
Emergency Municipal Hospital of Cuiabá (HPSMC)	62	73.8
Polyclinic	17	20.2
Family Health Strategy	1	1.2
Mobile Emergency Care Service (SAMU)	4	4.8
<b>Total</b>	<b>84</b>	<b>100</b>
<b>Who brought the victim for nursing care at HPSMC</b>	<b>No.</b>	<b>%</b>
Mother	48	57.1
Not informed	22	26.2
Others	4	4.8
Mobile Emergency Care Service	4	4.8
Father	1	1.2
Stepmother	1	1.2
Grandfather/mother	1	1.2
Sibling	1	1.2
Alone	1	1.2
Uncle/aunt	1	1.2
<b>Total</b>	<b>84</b>	<b>100</b>

The most frequently affected body regions were: head, neck, trunk, upper limbs and lower limbs (76-90.5%), followed by burn and corrosion in multiple body regions (5-5.9%) and burn and corrosion in eye/respiratory tract/internal organs (3-3.6%). Regarding the burn depth, second-degree burns were more frequent (34-40.5%), followed by first-degree burns and (14-16.7%) and third-degree burns (5-5.9%). The records of many patients did not present this information (31-36.9%). No case of immediate physical sequelae was reported.

All cases of burn treated at the Emergency Municipal Hospital of Cuiabá were referred to the Burn Treatment Center of the hospital and, for this reason, despite the discharge from emergency care, the patient remained hospitalized in the center, or came in at least once a week for replacing wound dressings. No immediate death or death during the nursing care at the Emergency Municipal Hospital of Cuiabá was reported.

**DISCUSSION**

Similar results were obtained in other studies<sup>(13-14)</sup>, but this study observed more female victims, differing from national<sup>(2,10,13-14)</sup> and international<sup>(3,6)</sup> studies, which show prevalence of male victims. One possible explanation of this finding may be related to the imitative behavior of girls in relation to their mothers or other people in charge of household chores, like cooking, handling pans with hot food, using household appliances and flammable substances, such as alcohol.

Considering the aforementioned, prevention measures should be encouraged through health policies and population preparation to identify and eliminate risks of home burns<sup>(15)</sup>. In addition, activities involving risks of burn should not be performed in the presence of children, or when holding them<sup>(16)</sup>. A study indicates

many home burns happen in the presence of a child's parent and, besides the risk factors, parent carelessness and negligence are also observed<sup>(4)</sup>.

The nursing care provided to the victims from other municipalities is explained by the fact that this is a service of reference for urgency and emergency care in Cuiabá and its adjacent areas, and for this reason, the suggested interventions are also relevant to neighboring municipalities.

The highest proportion of home burns caused by scalding and hot substances (such as cooking oil and food) is also observed in other investigations<sup>(2,10,17)</sup>. This type of accident, known as "hot kettle syndrome", occurs, in most cases, when a child moves a container with boiling water on the stove, and it is attributed to the child's easy access to environments of risk, such as kitchen or leisure area with the presence of a stove<sup>(2,14)</sup>.

Hence, some preventive measures should be adopted at home, such as: do not allow children to remain or play in the kitchen, continuously supervise children when they have to be in the kitchen, parents should not hold breastfed infants while handling heated fluids. Pan handles should not be within a child's reach and should be pointed towards the internal area of the stove. In the bathroom, hot water in a bucket or bathtub represents a risk to unsupervised children, and the water temperature should be checked before the bath using a thermometer or the back of hand. Hot foods or substances in containers should not be within a child's reach or on tablecloths that could be pulled by the child, causing a fall of hot food/substance over the child<sup>(18-19)</sup>.

The concern about these precautions requires an understanding of circumstances of burns and risk and protective factors that promote this type of accident at home<sup>(16)</sup>. A higher frequency of scalding in children of less than five years old is also confirmed by other studies<sup>(2-3,13)</sup>, which could be explained by the singular characteristics of children of this age group, such as curiosity and the tendency to imitate behaviors of adults, which are predisposing factors to accidents, combined with the lack of maturity to prevent and avoid risk situations<sup>(20)</sup>. In this sense, providing a safe environment in this phase of life has shown to be an important preventive measure, as well as constant surveillance of children to prevent risk situations to burns.

Other safety measures should also be adopted, considering this study also identified burns caused by contact with hot household appliances, through electric shock, direct flame and cigarette. Children should not have access to household appliances, matches, lighters and candles. Simple preventive measures can be efficient in accident prevention, such as putting away the clothes iron, sandwich maker and other hot appliances, out of children's reach after use, children should not be allowed in the kitchen while the oven is used, protect wires, power cables and outlets, as well as precautions with baby bottles heated in the microwave oven, whose content tends to heat more than the container, and special attention should be dedicated to vaporizers. In addition, playing with firecrackers and fireworks should be avoided, as they involve risk of burns and even loss of a limb. Another behavior that is commonly imitated by children and adolescents is smoking, a habit that should not occur near children and adolescents, not only because of the risk of burn. Sun exposure should also be avoided, with the recommended time for exposure being before

10 am and after 4 pm<sup>(18-19)</sup>.

Another study also found a small variation of burns when comparing the months of a year, with more cases reported in June (22.4%)<sup>(2)</sup>. This way, it is important to reinforce safety measures against home burns all through the year, and especially when conducting activities that caused the highest number of accidents, such as contact with hot drinks, foods, fats and fluids (scalding) and cooking oils and when handling hot household appliances.

Also regarding the days of the week, a similar distribution of home burns was observed; therefore, precautions should be reinforced on both weekdays and weekends.

The lack of records indicating the time the burn happened shows poor quality of information in the emergency service records kept by the hospital. This obstacle was also reported by another epidemiologic study based on an emergency service<sup>(17)</sup>, suggesting the need for a proper training of the healthcare team to make them aware of the health information importance<sup>(21)</sup>, or for the development of a service protocol that foresees complete information records.

Regarding the first nursing care, despite the fact that the mother or another legal guardian took the child to the Emergency Municipal Hospital of Cuiabá, all cases had the first nursing care provided by a health center. None of them reported first care at home, which could be related to the legal guardians' unpreparedness for the provision of first care. A study about the first care in cases of burn highlights that proper and early treatment of burn injury helps reduce burn damages and sequelae, once the final prognosis of a burn depends on a prompt and proper first care<sup>(22)</sup>.

In view of these facts, health education to population, parents and legal guardians is important and necessary, in terms of first care in case of burn, such as: removing immediately the source of heat, placing the victim away from the burning agent (flame, electric current, hot object), cooling the burned area with clean and running water (tap or shower) for 10-20 minutes (never use cold water, toothpaste, hydrating cream or home-made mixture), keeping the victim warm, and referring to a medical or emergency care service<sup>(15,22)</sup>.

A higher frequency of injuries on the head, thorax and upper limbs is confirmed by studies that reported a higher frequency of injuries on thorax and upper and lower limbs<sup>(2,14)</sup>. The injury site identification is extremely important to evaluate the risks and monitor physiological, anatomical and immunological changes of damages aiming to reduce sequelae<sup>(11)</sup>.

Regarding injuries, second-degree burns are reported as the most frequent type of burn<sup>(14,23)</sup>, which involves intense pain and takes 25 to 35 days to re-epithelialize, with scars showing unsatisfactory esthetical results<sup>(11)</sup>. Therefore, the importance of immediate and effective first care is once again highlighted, aiming to minimize injuries<sup>(22)</sup>.

Although the study did not identify any immediate physical sequela, most burns required long follow-up and treatment covering more than the emotional impact, which may cause psycho-emotional sequelae in the long run<sup>(11)</sup>.

Regarding the progress of home burns, because all cases were treated at the Burn Treatment Center of the hospital where this study was conducted, this investigation did not include hospitalization cases, considering that only emergency records were analyzed, not medical records. However, a study with child and adolescent victims of burns found a mean length of stay of 5.87 days<sup>(2)</sup>, and another study, which related the length of stay to the type of burn, showed second-degree burns require longer lengths of stay<sup>(12)</sup>. Thus, although this study did not report the length of stay or any immediate death, the severity of burns was observed due to the high number of second-degree burns.

## CONCLUSION

The objective of this study was to analyze the characteristics of home burns among children, adolescents and young adults (0 to 24 years of age) treated at an urgency/emergency service of reference. The results show female patients of 1 to 4 years old and male patients of 10 to 14 years of age were more affected by home burns.

It should be noted that, unlike other studies, female patients were more affected than male patients, suggesting additional studies are required with this group, mainly because of the characteristics of this group to imitate or help their mothers in household chores.

This finding highlights the importance of providing preventive and educational activities oriented to female victims. These activities may be part of the agenda of health professionals, in particular, those working with primary care, considering the nursing team has the possibility to learn more about the reality of families through home visits, which allows to provide guidance to parents, legal guardians and sitters, drawing their attention to different risks and ways to eliminate them, taking into account each home reality.

In addition, the findings of this study also suggest that, besides educational interventions implemented in various places for children and adolescents addressing the risks of burns caused by different factors at home and ways to prevent them, guidance about the correct way to conduct a quick and proper first care should be a priority. These actions may be efficient in preventing complications resulting from burns.

Understanding potential risk factors present in home burn accidents with this population still presents important gaps that should be filled to better understand the behavior of children, adolescents and young adults involved in these accidents. Thus, the planning of interventions based on understanding this reality may be more efficient.

The poor quality of information in the emergency service records kept by the hospital shows the need for a better monitoring system and activities for increasing awareness and qualification of health professionals regarding data records.

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