Original Article

Burns in children and adolescents: hospital morbidity and mortality analysis*

Queimaduras em crianças e adolescentes: análise da morbidade hospitalar e mortalidade

Quemaduras en niños y adolescentes: análisis de la morbilidad hospitalaria y de la mortalidad

Christine Baccarat de Godoy Martins[1], Selma Maffei de Andrade[2]

ABSTRACT

Objective: this research analyzed the hospital incidence and mortality due to burns in children aged less than 15 who live in Londrina, and were treated in emergency services, hospitalized or who died because of this in 2001. **Methods**: This is a descriptive study. Morbidity data were obtained from the five geral hospitals of Londrina, and mortality data came from the Municipal Mortality Information Nucleus of the city. The Software Epi Info, version 6.04d was used for data analysis. **Results**: 182 Children under age 15, victims of burns have been studied, being 82.4% wounded by hot materials or heat source, 14.3% by exposition to smoke/fire/flame and 3.3% by exposition to electric current. Male victims were predominant (56.6%), with the highest coefficient for the age of one year (6.1 per 1000 children). The hospitalization rate was 12.6%; one death occurred. 56.5% of the cases stayed in hospital for one to three days. **Conclusions**: the findings contribute to increasing epidemiological knowledge of such events, highlighting the need for preventive measures.
Keywords: Burns; Accidents, home; Morbidity; Infant mortality; Child; Adolescents

RESUMO

Objetivo: Analisar a incidência hospitalar e a mortalidade por queimadura em menores de 15 anos, residentes em Londrina, atendidos em pronto-socorro, internados ou que foram a óbito em 2001. **Métodos**: Trata-se de estudo transversal e descritivo, cujos dados de morbidade foram obtidos nos serviços de emergência e internação dos cinco hospitais de Londrina e os de mortalidade no Núcleo de Informação em Mortalidade do município. Para análise e tratamento dos dados, utilizou-se o programa computacional Epi-Info – versão 6.0.d. **Resultados:** Foram estudados 182 casos de menores de 15 anos vítimas de queimadura: 82,4% por substância quente / fonte de calor; 14,3% por exposição à fumaça / fogo / chama; 3,3% por exposição a corrente elétrica. Predominou o sexo masculino (56,6%) e a idade de um ano (6,1 por 1000 crianças). A taxa de internação foi de 12,6%, ocorrendo um óbito. O período de internação foi de um a três dias em 56,5% dos casos. **Conclusões:** Os achados contribuem para ampliar o conhecimento epidemiológico de tais eventos, reforçando a necessidade da prevenção.
Descritores*:* Queimaduras; Acidentes domésticos; Morbidade; Mortalidade infantil; Crianças; Adolescentes

RESUMEN

Objetivo: Analizar la incidencia hospitalaria y la mortalidad por quemadura en menores de 15 años, residentes en Londrina, atendidos en el servicio de emergencia, internados o que murieron en el 2001. **Métodos**: Se trata de un estudio transversal y descriptivo, cuyos datos de morbilidad fueron obtenidos en los servicios de emergencia e internamiento de los cinco hospitales de Londrina y los de mortalidad en el Núcleo de Información en Mortalidad del municipio. Para el análisis y tratamiento de los datos, se utilizó el programa Epi-Info – versión 6.0.d. **Resultados**: Fueron estudiados 182 casos de menores de 15 años víctimas de quemadura: 82,4% por sustancia caliente / fuente de calor; 14,3% por exposición al humo/ fuego / llama; 3,3% por exposición a la corriente eléctrica. Predominó el sexo masculino (56,6%) y la edad de un año (6,1 por 1,000 niños). La tasa de internamiento fue de 12,6%, ocurriendo una muerte. El período de internamiento fue de uno a tres días en un 56,5% de los casos. **Conclusiones:** Los hallazgos contribuyen en la ampliación del conocimiento epidemiológico de tales eventos, reforzando la necesidad de la prevención.
Descriptores*:* Quemaduras; Accidentes domésticos; Morbilidad; Mortalidad infantil; Niños; Adolescentes

---

* *Study performed in Municipal Hospitals in Londrina, Paraná (PR), Brazil.*

[1] *Student of the Graduate Program, Pediatric Nurse at the Regional University Hospital of Northern Paraná – Londrina State University - UEL- Londrina, Paraná (PR), Brazil.*

[2] *PhD., Professor of the Collective Health Department at Londrina State University - UEL- Londrina, Paraná (PR), Brazil.*

Corresponding Author: **Christine Baccarat de Godoy Martins**
R. Chile, 185 - Apto. 103 A - Vila Canziane - Londrina - PR
Cep: 86010-220. E-mail: leocris2001@terra.com.br

Received article **16/04/2007** and accepted **13/09/2007**

INTRODUCTION

Burn injuries are major accidental causes of morbimortality all over the world, especially among children[1-3]: scalding (caused by hot substances or heat sources) is the most common, followed by chemical, electrical and radioactive burns[4-5].

The high number of burns in children younger than five years old[3,6-7] stands out because of physical and psychological hardship and high social and economical cost, including hospital expenses.

A study on admissions in private or SUS-associated hospitals in 2000 showed that on average, R$ 649.43 were spent on hospital stays due to non-fatal burn and R$ 1,620.27 on patients who died[8].

Several studies point burns as one of the most frequent accidental causes among children and adolescents[3, 9-12]. In 2006, 16,573 children and adolescents under 15 years old were hospitalized because of burns. That number represents 14% of all admissions because of external causes in this group[13]. In 2005, 373 adolescents younger than 15 years old died because of burns in our country (10.8% of death by external cause in this age group)[14].

In spite of all knowledge of morbimortality, it is still necessary to identify the victims in order to gain more epidemiological knowledge of that important cause of infant morbimortality. A detailed analysis of this event is vindicated in order to outline a diagnosis that will support planning effective actions of control and prevention to reduce the problem, thus decreasing hospital demand due to that condition.

The goal of this study was to study the incidence of hospital admission and mortality because of burns among adolescents under 15 years old in the city of Londrina.

METHODS

This is a transversal and descriptive study on hospital morbidity and mortality due to burns. The population who participated in the study was made up of adolescents under 15 years old from Londrina (Paraná). They were burn victims from January 1st to December 31st, 2001, assisted at hospitals in that city (emergency and hospital admission services) or who died in the same year.

Nursing students at the State University in Londrina, strictly trained and supervised by the authors of this paper, collected data about morbidity (emergency room attention and hospital admissions) by investigating medical records in five hospitals of the city: Hospital Universitário Regional do Norte do Paraná (public school hospital with 241 beds), Hospital Dr. Anísio Figueiredo (public hospital with 56 beds), Hospital Dr. Eulalino Andrade (public hospital with 41 beds), Hospital Evangélico de Londrina (private Hospital with 203 beds) and Hospital Infantil Sagrada Família (private, SUS-associated hospital with 68 beds). They used a previously-tested questionnaire (100 pre-tests with data from the previous year), consisting of 21 (twenty-one) closed-ended questions divided in four parts: child identification data (name, date of birth, age at the moment of the accident, gender), data about the accident (date, part of the body that was affected, agent), consequences of the accident (attention at emergency rooms, hospital admission, length of the admission, death).

A list with all deaths of children under 15 years old in the city because of burns in 2001, was obtained from the Mortality Information Center in the city, in case death could have occurred before medical assistance could be provided.

The kind of burn (conditions) and the kind of injury were classified respectively according to chapters XX and XIX of the International Classification of Diseases – CID10[15] . Software Epi-Info – version 6.0.d[16], was used for data analysis, and treatment and outcomes were divided in three analysis groups according to CID10: exposure to electric current: smoke/fire/flames; hot substance or heat source. The coefficient of incidence was calculated based on the estimated population in the same age group and year. This study was approved by the Ethics in Research Committee at the State University in Londrina, CEP, n.º 126/02.

RESULTS

182 burn cases in youths under 15 years old were studied.

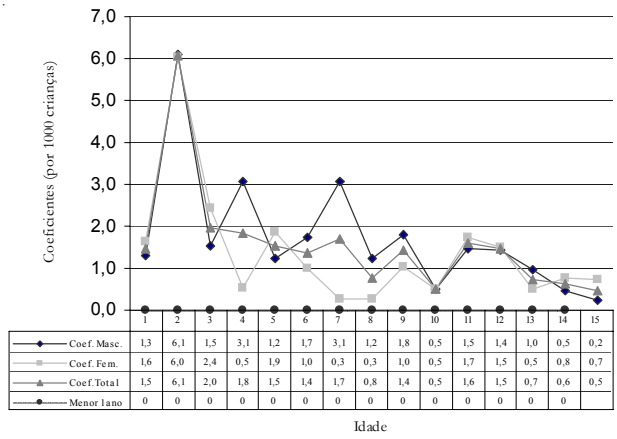
82.4% of the cases were burns due to hot substances or heat sources (150 cases); 14.3% (26 cases) happened because of exposure to smoke, fire, and flames; and 3.3% (6 cases) were due to exposure to electric current.

Analyzing the three burn categories altogether, there were more cases involving males (56.6%) and 1-year-old children (6.1 out of 1,000 children) (Figure 1). The parts of the body mainly affected were head, neck, chest and limbs (73.0%).

Out of 182 cases, 158 (86.8%) received attention and were released at emergency rooms, 23 (12.6%) cases needed to be hospitalized, with one death (0.6%). Among the hospital admission cases, more than half (56.5%) stayed in the hospital for up to three days, 34.8% stayed there from four to eight days, and 8.7% stayed there from nine to ten days.

Among 150 children victimized by exposure to hot substances or heat sources, hot/boiling liquids (44.0%) were mainly responsible for that kind of burn (Table 1). Regarding the burned body parts, trunk and upper limbs were the most frequently affected (44.5%), followed by burns over multiple regions (20.3%), hip and lower limbs (19.8%), head and neck (13.7%), eyes and internal organs

(1.1%), and smoke effect on lungs (0.5%).



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Coef. Masc.	1,3	6,1	1,5	3,1	1,2	1,7	3,1	1,2	1,8	0,5	1,5	1,4	1,0	0,5	0,2
Coef. Fem.	1,6	6,0	2,4	0,5	1,9	1,0	0,3	0,3	1,0	0,5	1,7	1,5	0,5	0,8	0,7
Coef. Total	1,5	6,1	2,0	1,8	1,5	1,4	1,7	0,8	1,4	0,5	1,6	1,5	0,7	0,6	0,5
Menor 1 ano	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Figure 1 – Distribution of burn incidence coefficients in youths younger than 15 years old, Londrina, 2001.

Table 1 – Distribution of youths under 15 years old victimized by accidents due to exposure to hot substances or heat source according to agent involved, Londrina, 2001.

Agent	N	%
Hot/boiling liquids	66	44,0
Motorcycle exhaust	6	4,0
(Pressing) Iron	4	2,7
Hot household appliance	2	1,3
Hot oven	2	1,3
Cooker	2	1,3
Hot Steam	2	1,3
Non-specified agent	66	44,0
Total	**150**	**100,0**

Out of 26 children victims of accidents due to smoke, fire and flame exposure, 34.6% were between 10 and 14 years old; there were no cases among children under 1 year old. Alcohol (30.8%), gasoline (15.4%) and kerosene (11.5%) were mainly responsible for that burning category (Table 2). Five cases (19.2%) needed hospital admission, 21 cases (80.8%) were assisted only at emergency rooms. There were no deaths. For every hospital admission because of exposure to smoke, fire and flames, nearly four cases were assisted at emergency rooms.

Table 2 – Distribution of youths under 15 years old victimized by burns because of exposure to smoke, fire and flames according to agent involved, Londrina, 2001.

Agent	N	%
Alcohol	8	30,8
Gasoline	4	15,4
Kerosene	3	11,5
Smoke	1	3,8
Non-specified Agent	10	38,5
Total	26	100,0

All six cases of accidents due to exposure to electric current needed hospital admission (100%). 5 cases (83.3%) were linked to household electric current shock and one case was associated to contact with cables on lampposts (kite tangled up on high voltage wires resulting in death), increasing the mortality rate to 16.7% among victims of that kind of burn.

DISCUSSION

Other studies have also found that there are more infant accidents among boys[3, 10, 12, 17-20], and these can probably be linked to differences in gender behavior and cultural factors, which establish more freedom for boys, while girls are more closely watched.

Different activities performed by males and females are another explanation for that percentage; boys are exposed more often because they engage in riskier activities.

Some authors state that age can be a risk for accident cases[10, 21-22] . In general, younger children sustain more burns, drowning, poisoning, and falls; older ones sustain more car run-overs and falls from bicycles; and adolescents are more often victimized by drowning, traffic traumas, and gun injuries[23-24]. A higher burn incidence involving one-year-olds is probably associated to characteristics of child development in that stage. At this age, curiosity, immaturity, and lack of motor coordination put children at risk. Besides, easy access to the kitchen and inappropriate child supervision can contribute to the incidence of those events.

Like the results found in this study, others[3, 25] have also found higher incidence of scalding (burns with hot substance) among children.

Few studies mention the part of the body that was affected, classifying burns according to body extension[24]. The highest number of burns on head/neck/chest/limbs can be related to the position that the child is in relation to the flames. Small children pull containers with hot liquid towards them, such as pans on the stove, serving dishes on the table, and bowls with clothes soaked in hot water, frequently hitting the head, neck and thorax. The contact with hot household gadgets also explains burns on superior limbs, especially hands touching the object because of curiosity. Adolescents, when setting fire on barbecue grills and the like, are usually standing next to them, being hit more often on the face, chest and superior limbs. Younger children, when playing with matches and lighters, usually are sitting on the floor with the object among their legs, which could facilitate burns on inferior limbs.

Other studies have found longer hospital stays for burn victims, as well as higher mortality rates than the

results found in this research[26]. However, it is necessary to consider the differences between the populations studied, because the results in the literature focus on specific burn treatment units, and they can concentrate on more serious cases, leading to differences in the rates of hospital stays and mortality rates.

The researchers[3, 10, 17, 27] also report about hot liquids being the main agent of child burns because of easy access to environments such as the kitchen[3]. Therefore, we can state that changes in the environment would be enough to avoid infant burns. Some efficient and low cost measures to avoid suffering and consequences involving children victims of burns are: keeping the child away from hot ovens, not leaving pan handles ponting outwards from the stove, or hot food on the table covered with tablecloths that can be pulled by the child, keeping hot pressing irons and electrical equipment in high places, limiting the child's access to the kitchen and laundry. It is necessary to have an appropriate place to keep a vehicle with its exhaust pipe against the wall, along with special attention to children being carried on the back of a motorcycle.

Other studies[3] found similar results in relation to average length of hospital stays among children exposed to hot substances or heat sources (15%), but a mortality rate of only 4.0%. Zero mortality rate in our study can be related to the fact that some burned children are referred to the Center of Burn Treatment in Curitiba, where specialized and reference service for burn treatment can be found. Deaths might have occurred in that institution, and, as such, were not included in our study.

Families should be advised to take preventive measures because injuries after exposure to hot substances or heat sources can be severe, and treatments can be long, resulting in emotional and physical consequences.

Another study showed that exposure to smoke, fire and flames is higher among adolescents (10 to 14 years old)[3]. As toddlers are still not able to deal with matches or lighters, this kind of accident does not happen to them, but many times, when older children and adolescents try to set fire on barbecue grills or the like, they hurt themselves[22].

Other studies also point out that matches, lighters, and specific kinds of fuel are the main cause of fire exposure among children[3, 19, 27] .Although those agents are not described in patients records, alcohol, gasoline, and kerosene only catch on fire when they are in contact with matches or lighters. It is necessary to keep those products away from children, and the real need of having alcohol, gasoline and kerosene at home is questionable. One study [18] says that fires caused by matches and lighters happened when mothers were at work, outside the household (from 8:00 a.m. to 8:00 p.m.). That fact restates the lack of appropriate observation and the need of campaigns to make parents and communities aware of this problem. More specific measures, such as manufacturers adapting safety devices in lighters and matches, which would make their use more difficult for children, must be considered in order to decrease the incidence of those events.

Other studies found higher mortality coefficients of fire burning[19]. It is important to consider cultural and environmental differences among countries. Although mortality rate is null among those events, fire and flames burns usually cause physical and emotional pain because of the consequences. Thus, investing in specific prevention measures means investing in quality of life for children.

The same hospital stay standards (100%) were also observed in research in relation to exposure to electric current[28].

Protecting sockets, removing extensions that can facilitate accidents and keeping electrical appliances away from children can prevent electrical shocks. Another study[28] has also identified burns due to high voltage wires because of the habit of flying kites. Therefore, older children who fly kites must be advised and they must play away from the electrical grid and high voltage wires. High rates of hospital admission and deaths show how serious this kind of accident is.

It is essential to investigate how the event occurred when healthcare is being provided in order to support interventions, since many times the professional misses this information because of the great demand or lack of pre-established routine. Among other factors, such events may involve violence and mistreatment. That can make analysis of external causes regarding circumstances and distribution more difficult, leaving out important data that can help the success of the measures adopted. Considering that it is possible to plan actions of prevention and intervention only if there is specific knowledge about the causes, better information about external causes, in relation to how an event occurred, can provide support for more efficient and specific measures for decreasing its incidence[29]. Thus, professionals that are responsible for attention to children and adolescents must be advised and trained in relation to that problem. Using standardized protocols for external cause injuries can help in that sense. Precise information can be used to design the epidemiological profile of those causes of the infant-youth population that comes to the hospitals and emergency rooms.

CONCLUSIONS

Infant burning is an important cause of hospital admission and medical attention, and results in important physical and emotional consequences. Most infant burns happen at home, suggesting that some preventive measures besides direct supervision of the child are needed.

The lack of knowledge about risky situations adds to the occurrence of those events. Therefore it is necessary to develop actions to increase awareness through educational programs at schools and communities as well as prevention campaigns in the media, promoted by executive, legislative and judiciary powers.

Prevention must target each stage of a child's development, and coaching on individual or collective activities at schools and communities provides necessary information about infant accident prevention.

The results presented in this study point out the significance of actions of prevention and control, as well as new studies that will narrow the knowledge gap and help fight that important infant problem: burn occurrences.

REFERENCES

1. Wernech GL, Reicheinheim ME. Paediatric burns and associated risk factors in Rio de Janeiro, Brazil. Burns. 1997;23(6):478-83.
2. Rossi LA, Barruffini RC, Garcia TR, Chianca TM. Queimaduras: características dos pacientes admitidos em um Hospital Escola de Ribeirão Preto (SP) Brasil. Rev Panam Salud Publica. 1998;4(6):401-4.
3. Costa DM, Abrantes MM, Lamounier JA, Lemos ATO. Estudo descritivo de queimaduras em crianças e adolescentes. J. Pediatr (Rio de J). 1999;75(3): 181-6.
4. Rodriguez JG. Childhood injuries in the United States: a priority issue. Am J Dis Child. 1990;144(6):625-6.
5. Rossi LA, Ferreira E, Costa ECFB, Bergamasco EC, Camargo C. Prevenção de queimaduras: percepção de pacientes e de seus familiares. Rev Latinoam Enferm. 2003;11(1):36-42.
6. Lebrão ML, Mello Jorge MHP, Laurenti R. II-Morbidade hospitalar por lesões e envenenamentos. Rev Saúde Pública. 1997;31(4 Supl):26-37.
7. Baracat ECE, Paraschin K, Nogueira RJN, Reis MCR, Fraga AMA, Sperotto G. Acidentes com crianças e sua evolução na região de Campinas, SP. J Pediatr (Rio de J). 2000;76(5):368-74.
8. Jorge MHP, Koizumi MS. Gastos governamentais do SUS com internações hospitalares por causas externas: análise do Estado de São Paulo, 2000. Rev Bras Epidemiol. 2004;7(2):228-38.
9. Vico ESR, Laurenti R. Mortalidade de crianças usuárias de creches no Município de São Paulo. Rev Saúde Pública. 2004;38(1):38-44.
10. Gaspar VLV, Lamounier JÁ, Cunha FM, Gaspar JC. Fatores relacionados a hospitalizações por injúrias em crianças e adolescentes. J Pediatr (Rio de J). 2004;80(6):447-52.
11. Paes CEN, Gaspar VLV. As injúrias não intencionais no ambiente domiciliar: a casas segura. J Pediatr (Rio de J). 2005:81(5 Supl):S146-54.
12. Camargo CL, Sampaio AL, Xavier EA, Santos LT. Lesões por queimaduras: o reflexo da violência em crianças e adolescentes. Rev Bras. Crescimento Desenvolv Hum. 2002:12(2):52-8.
13. Brasil. Ministério da Saúde (DATASUS). Morbidade por Queimadura, 2006 [texto na Internet]. Brasília: Ministério da Saúde [citado 2007 Jun 12]. Disponível em: http://www.datasus.gov.br/datasus/datasus.php
14. Brasil. Ministério da Saúde (DATASUS). Mortalidade por Queimadura, 2005. [texto na Internet]. Brasília: Ministério da Saúde [citado 2007 Jun 12]. Disponível em http://www.datasus.gov.br.
15. Organização Mundial de Saúde. Classificação Internacional de Doenças (CID-10). Centro Colaborador da OMS para a Classificação de Doenças em Português. 8a ed. São Paulo: EDUSP; 2000.
16. Dean AG, Dean JA, Coulombier D, Brendel KA, Smith DC, Burten AH, et al. EPI INFO version 6: word processing, database and statistics program for epidemiology on microcomputers for Center Disease Control and Prevention. Atlanta: CDC; 1995.
17. Harada MJCS, Botta MLG, Kobata CM, Szauter IH, Dutra G, Dias EC. Epidemiologia em crianças hospitalizadas por acidentes. Folha Méd. 2000; 119(1):43-7.
18. Filócomo FRF, Harada MJCS, Silva CVS. Estudo dos acidentes na infância em um pronto socorro pediátrico. Rev Latinoam Enferm. 2002;10(1):41-7.
19. Istre GR, McCoy M, Carlin DK, McClain J. Residential fire relates deaths and injuries among children: fireplay, smoke alarms, and prevention. Inj Prev. 2002;8(2):128-32.
20. São Paulo. Secretaria de Estado da Saúde de São Paulo. Coordenadoria de Controle de Doenãs. Centro de Vigilância Epidemiológica "Prof. Alexandre Vranjac!. Grupo Técnico de Prevenção de Acidentes e Violências. Internações hospitalares por causas externas no Estado de São Paulo em 2005. Rev Saúde Pública. 2007;41(1):163-6.
21. UNICEF Innocenti Research Center. A league table of child deaths by injury in rich nations [monography on the Internet]. Florence, Italy; UNICEF; 2001. (Innocenti Report Card No 2) [cited 2007 Jun 12]. Available from: http://www.unicef-irc.org/publications/pdf/repcard2e.pdf
22. Blank D. Manual de acidentes e intoxicações na infância e adolescência. Sociedade Brasileira de Pediatria. Comitê de Acidentes. Rio de Janeiro: Schering-Plough; 1994.
23. Waksman RD, Gikas RMC. Segurança na Infância e Adolescência. Sociedade de Pediatria de São Paulo. Departamento de Segurança da Criança e do Adolescente. São Paulo: Atheneu; 2003. (Série Atualizações Pediátricas)
24. Campos JA, Paes CEN, Blank D, Costa DM, Pfeiffer L, Waksman RD. Manual de Segurança da Criança e do Adolescente. Sociedade Brasileira de Pediatria/Nestlé Nutrição, 2004.
25. Alcóser Cordero P, Guerrero Vera P, Ronero Aguilar Y. Quemadura por explósion de líquido inflamable. A propósito de um caso em pediatria. Medicina (Guayaquil). 2002;8(4):278-82.
26. Beraldo PSS, Nunes LGN, Silva IP, Ramos MFG. Sazonalidade de queimaduras por fogo em pacientes admitidos numa unidade especializada do Distrito Federal, no período 1993-1996. Brasília Méd. 1999;36(3/4):72-81.
27. Rossi LA, Barruffini RCP, Garcia TR, Chianca TCM. Queimaduras: características dos casos tratados em um hospital escola em Ribeirão Preto (SP). Rev Panam Salud Publica 1998;4(6):401-4.
28. Meza Ortiz F, Rojas Solis MB, Noriega Zapata PA. Quemaduras eléctricas en ninos. Reporte de tres casos relacionados con papalotes. Revisión de la literatura. Gac

Med Mex. 2000;136(4):373-7.
29. Drumond Junior M, Lira MMTA, Freitas M, Nitrini TMU, Shibao K. Avaliação da qualidade das informações de mortalidade por acidentes não especificados e eventos com intenção indeterminada. Rev Saúde Pública. 1999;33(3):273-80.