Accidents involving children in the region of Campinas, Brazil

Emílio C.E. Baracat¹, Karen Paraschin², Roberto J.N. Nogueira³, Marcelo C. dos Reis³, Andréa M.A. Fraga³, Giuseppe Sperotto⁴

Abstract

Objective: evaluate prospectively the frequency and cause of accidents in children seen at the Pediatric Emergency Service of a University Hospital. The main aim is to subsidize the development of education and preventive programs.

Methods: data of all children, less than 14 years old, from March 1997 to February 1998 were collected with a standard questionnaire.

Results: accidents in 3,214 children were studied, 11.4% of the total. Males predominated (62.1%). Accidents were more common in the 9 to 13 year age group (33.4%), 2 to 5 year age group (27.2%) and 5 to 9 year group (25.5%). Traumatism, mainly due to falls, was the cause in 74%. Head trauma was important in the younger than 1 year, and trauma involving the extremities in the 9 to 13 age group. Bites and stings predominated in the 5 to 13 year age group, intoxication and foreign bodies in the 2 to 5 year’s age group. Burns predominated in the younger than 5 years. Most accidents (89.7%) were of low complexity but 20 patients had to be admitted to an ICU and 4 died in the Emergency Room.

Conclusions: the child older than 9 years, male, with trauma of the extremities due to a fall was the most frequent case of accident. Prevention programs must be targeted to specific age ranges. Accidents are responsible for a great part of the overload of Emergency Services as 89.7% were of low complexity. Primary care health facilities personnel must be trained to manage accidents that do not involve complex procedures.


Introduction

The study of accidents and their prevention has been the object of several works in the past years.¹,² Childhood trauma is the main cause of death among children and teenagers in the United States; it accounts for 30% of all deaths in this age group. In developed countries, the control of infectious diseases, achieved during the first half of the century, and the recent technological advance in the diagnosis of diseases brought the importance of accidents to the foreground.³ Thus, during the last decade the interest in prevention has improved, with researchers trying to understand the factors and processes through which accidents occur, the particular features of given accidents, and the social environment in which they take place.⁴,⁵

Along with clinical investigations, epidemiological studies with data collection in emergency rooms, traumatology centers, and other hospital-related sources, make it possible to quantify and identify risk factors with a preventive focus.⁶-⁹ They also allow the identification of

¹. Assistant Professor, Department of Pediatrics, School of Medical Sciences, Universidade Estadual de Campinas (UNICAMP).
². Undergraduate Student, School of Medical Sciences, Universidade Estadual de Campinas (UNICAMP).
³. Pediatrician, Emergency, Department of Pediatrics, School of Medical Sciences, Universidade Estadual de Campinas (UNICAMP).
⁴. Professor, Emergency, Pediatrician, Emergency, Department of Pediatrics, School of Medical Sciences, Universidade Estadual de Campinas (UNICAMP).
deficiencies in pre-hospital and hospital care, besides
deficiencies in the recognition of immediate prognostic factors. 10

It may be affirmed that the epidemiological model of
accident follows that defined for infectious diseases, which
has as components the agent, the host, and the environment.
This approach makes fortuitous aspects of the accident be
replaced by descriptions of lesions and of the physical and
chemical agents that have determined them. 11

In a general way, the identification of the risk for
accidents is important, according to the developmental
stage of the child and to the behavioral habits that are
common to the referred period, allowing the definition of a
prevention program targeted to each age group. 12
Predisposing factors, such as the socioeconomic level,
inadequate supervision, family stress, and improper dwelling
conditions must always be considered in the study of
childhood accidents. 13 Features of child’s personality
(hyperactivity, aggressiveness, impulsiveness, and
distraction), as well as different cognitive, perceptive, motor,
and language-related competencies, provide a better
knowledge about the child’s contributions for the occurrence
of accidents. 14-45

Diverse strategies have been suggested to minimize this
public health problem, which include intervention through
proper legislation (for example, drug bottles with inviolable
lids), and programs of health education in accordance with
the social reality of a given target region and which offer
direct contact with the families in order to elucidate attitudes
and practices in the prevention of childhood accidents. 16-18

In Brazil, studies about childhood accidents show that
most of them are diagnosed and treated in clinics and in
emergency services, and that they obey the iceberg model,
in which, for each death, there are approximately 45 lesions
that demand ambulatory treatment in emergency rooms. 19-21
In most cases, the child who suffered the accident is taken
to an emergency unit without undergoing the clear criteria
of reference, and usually presents nonsignificant lesions,
which could be treated in primary care facilities.

In Brazil, according to the Brazilian Society of Pediatrics,
external causes are responsible for 19.5% of the mortality
in the age group until adolescence, and they are the main
cause of death in the 5 to 19-year old group. Thus, it is
necessary that the issue is treated with priority, with the
implementation of prevention programs, along with the
training of health professionals and the fitness of primary
and secondary-level services to an efficient and resolvent
care.

Materials and methods

Campinas is a city located at approximately 90 km north
of São Paulo. The Hospital das Clínicas, Universidade
Estadual de Campinas, is the reference hospital for the city
and for surrounding areas, which correspond to
approximately 3.5 million of inhabitants. Infant mortality in
the reference area is about 18. Per capita income estimated
in 1998 was about US$ 7,500 a year.

This is a descriptive-prospective study, comprising the
period from March 1997 to February 1998. We admitted all
children from zero to incomplete 14 years of age victims of
accident, and assisted at the Pediatric Emergency service.
The patients were classified according to the previous
standardization based on the medical record. We used the
software EPI-Info v.6.04 for the data analysis.

Results

We studied 3,214 children victims of accidents, who
represented 11.4% out of a total of 28,192 appointments in
the period. There was a predominance of male children
(62.1%), with a ratio of 1.6 boy:1 girl. There was a balanced
distribution among the days of the week. Most patients
came from Campinas (67.5%), followed by the nearest
cities, Sumaré and Hortolândia. Regarding the total number
of appointments, there was a significantly higher percentage
in the distribution (P<0.05) of accidents in the cities of
Santo Antônio de Posse, Indaiatuba, São João da Boa Vista,
and Jaguariúna (Table 1).

The age group with the highest number of occurrences
was the 9 to 13 years group (33.4%), followed by the 2 to
5 years group (27.2%), the 5 to 9 years group (25.5%), and
the group of children younger than 2 years of age (13.9%).
Comparing these data with the total distribution of
appointments, we may observe an increasing percentage of
accidents in the older age groups, with the highest relative
incidence in the age group above 9 years (Table 2).

Traumatisms were responsible for 74.0% of the
assistance procedures (Table 3), and falls were the main
determining cause (Table 4). Analyzing the region
traumatized in the fall, we can observe a predominance of
lesions on upper and lower limbs, followed by cranioencephalic
trauma, with similar percentages (Table 5). However, when the number of accidents according to the
age group is analyzed, the occurrence of cranioencephalic
trauma due to falls acquires significant importance for those
younger than 1 year of age (94 accidents with cranioencephalic trauma in a total of 152 accidents). On the
other hand, falls with limb traumas are a characteristic of
older children, representing 32.6% of the total number of
accidents in the 9 to 13-year old group.

When we compare the diverse types of accidents to the
victim’s age group, we observe that stings, traumas, and
bites are evenly distributed in 5 to 13-year old children, with
a slight predominance of the two latter occurrences among
children above 9 years old. On the other hand, intoxication
and accidents with foreign bodies predominated in the 2 to
5-year old group (Table 6).
Regarding stings (112), we had 102 (91%) accidents with insects: spiders, 21 (19%); scorpions, 17 (15%); caterpillars, 13 (12%); beetles, 23 (21%); ants, 28 (25%); and snakes, 10 (9%).

In the diagnosis of foreign bodies, they were predominantly located in the nasal cavities and in the auditory duct (54.8%), followed by ingestion (37.8%), and aspiration (7.4%). In the latter group, 1 to 5-year old children predominated. Drugs, domestic and caustic products were responsible for most intoxication-related procedures.

Of a total of 56 burns, 48 were provoked by thermal energy, six by chemical energy, and two by electrical current, with a prevalence of the group of children younger than 5 years old (64.3% of the cases). Among thermal energy burns, 21 (44%) were due to hot liquids, 17 (35%) to flame, and 10 (21%) were due to the contact with hot surfaces.

Out of 106 vehicular accidents with the patients inside the vehicles, 70 suffered polytrauma. Of 113 pedestrian run-over injuries recorded, 37 children suffered craniocerebral trauma, and there were 55 cases of polytrauma.

Out of the total number of appointments, 1,418 accidents had low complexity (immediate discharge), and 1,465 required simple procedures. Only 7.4% of the patients remained in the unit for observation. There were 20 referrals to an intensive care unit, and four deaths in the emergency room (Table 7). Deaths were due to polytrauma (2) and drowning (2).

### Table 1 - Frequency and percentage of accidents and care appointments in the Pediatric Emergency Room from March 1997 to February 1998, according to city of origin

<table>
<thead>
<tr>
<th>City</th>
<th>Frequency of accidents</th>
<th>% of accidents</th>
<th>Frequency of care</th>
<th>% of care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campinas</td>
<td>2,170</td>
<td>67.5</td>
<td>19,407</td>
<td>68.8</td>
</tr>
<tr>
<td>Sumaré</td>
<td>254</td>
<td>7.9</td>
<td>2,198</td>
<td>7.8</td>
</tr>
<tr>
<td>Hortolândia</td>
<td>212</td>
<td>6.6</td>
<td>2,505</td>
<td>8.9</td>
</tr>
<tr>
<td>Santo Antonio de Posse</td>
<td>61</td>
<td>1.9</td>
<td>312</td>
<td>1.1*</td>
</tr>
<tr>
<td>Monte Mor</td>
<td>50</td>
<td>1.5</td>
<td>520</td>
<td>1.8</td>
</tr>
<tr>
<td>Indaiatuba</td>
<td>45</td>
<td>1.4</td>
<td>251</td>
<td>0.9</td>
</tr>
<tr>
<td>São João da Boa Vista</td>
<td>43</td>
<td>1.3</td>
<td>67</td>
<td>0.2*</td>
</tr>
<tr>
<td>Jaguariúna</td>
<td>37</td>
<td>1.2</td>
<td>169</td>
<td>0.6*</td>
</tr>
<tr>
<td>Artur Nogueira</td>
<td>29</td>
<td>0.9</td>
<td>130</td>
<td>0.5</td>
</tr>
<tr>
<td>Cosmópolis</td>
<td>25</td>
<td>0.7</td>
<td>92</td>
<td>0.4</td>
</tr>
<tr>
<td>Paulínia</td>
<td>24</td>
<td>0.7</td>
<td>92</td>
<td>0.4</td>
</tr>
<tr>
<td>Santa Bárbara D’Oeste</td>
<td>18</td>
<td>0.6</td>
<td>164</td>
<td>0.6</td>
</tr>
<tr>
<td>Others</td>
<td>343</td>
<td>10.6</td>
<td>2,710</td>
<td>9.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,214</strong></td>
<td><strong>100.0</strong></td>
<td><strong>28,192</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

* Significant difference (P<0.05) between number of patients and patients involved in accidents.

### Table 2 - Frequency and percentage of accidents and appointments in the Pediatric Emergency Room from March 1997 to February 1998, according to age group

<table>
<thead>
<tr>
<th>Age group</th>
<th>Frequency of accidents</th>
<th>% of accidents</th>
<th>Frequency of care</th>
<th>% of care</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 year old</td>
<td>152</td>
<td>4.7</td>
<td>2,992</td>
<td>10.6</td>
</tr>
<tr>
<td>1 to 2 years old</td>
<td>296</td>
<td>9.2</td>
<td>5,638</td>
<td>20.0</td>
</tr>
<tr>
<td>2 to 5 years old</td>
<td>872</td>
<td>27.2</td>
<td>8,289</td>
<td>29.4</td>
</tr>
<tr>
<td>5 to 9 years old</td>
<td>820</td>
<td>25.5</td>
<td>5,729</td>
<td>20.3</td>
</tr>
<tr>
<td>9 to 14 years old</td>
<td>1,074</td>
<td>33.4</td>
<td>5,544</td>
<td>19.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,214</strong></td>
<td><strong>100.0</strong></td>
<td><strong>28,192</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Discussion

Accidents occur when the characteristics of the host, the agent, and the environment act together in given circumstances and within an exact period of time. Clinical manifestations vary from small cuts and ecchymoses to multiple traumas and death. The evolution model of the patients is similar to the iceberg model, reporting high morbidity and low mortality.

<table>
<thead>
<tr>
<th>Cause of trauma</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>1,594</td>
<td>67.1</td>
</tr>
<tr>
<td>Pedestrian run-over injury</td>
<td>113</td>
<td>4.7</td>
</tr>
<tr>
<td>Traffic accident</td>
<td>106</td>
<td>4.5</td>
</tr>
<tr>
<td>Rural accident</td>
<td>4</td>
<td>0.2</td>
</tr>
<tr>
<td>Beating</td>
<td>5</td>
<td>0.2</td>
</tr>
<tr>
<td>Stab wound</td>
<td>16</td>
<td>0.7</td>
</tr>
<tr>
<td>Gunshot wound</td>
<td>5</td>
<td>0.2</td>
</tr>
<tr>
<td>Others</td>
<td>533</td>
<td>22.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,376</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

In the study, the highest incidence occurred in the age group above 9 years (33.4%), and there was a predominance of male children, confirming other studies data.10,11,22,23

Traumatism continues to be the main cause of morbimortality in childhood accidents. It was the cause of accidents in 74.0%, with a concentration in children above 9 years old, probably because in this age group, there is more interaction with the environment and more risk activities. We should also stress, in this group, the importance of falls followed by limb lesions, which constitute the characteristic of an age group that has already developed the reflex of protecting their head when they fall. In opposition, in the group comprising children younger than 2 years, the predominant accidents were falls from their own height with cranioencephalic trauma, due to the features of the neurological development in this group. Falls constitute the most frequent cause in childhood accidents; in the USA, they represent the fourth most common cause of death due to trauma in all age groups.23,25 The circumstances surrounding this kind of accident also vary according to the age group. In infants, falls from somebody’s arms and from bed prevail; among pre-school children, we have falls from stairs; during school age, falls related to bicycles and sports practice prevail.22,23 It is known that bicycle accidents cause significant morbidity and mortality, with a high rate of life risk.22,23 The use of helmets, the development of educational programs, the performance of environmental modifications, and the observance of traffic rules could avoid most of these accidents.

Motor vehicle pedestrian injuries, even representing only 4.7% of traumatisms, are really serious, because they are associated with cranioencephalic trauma and polytrauma.24 The same happens to vehicular accidents. These data confirm studies in the USA, where every year, 2,000 children and teenagers die, and other 110,000 are injured due to accidents involving automotive vehicles.26

Along with trauma, bites and stings prevail in children who are older than 5 years of age, probably due to the same characteristics of the relation of this age group with the environment. On the other hand, the distribution of accidents...
Table 6 - Distribution of types of accidents at the Pediatric Emergency Room from March 1997 to February 1998, according to the age group

<table>
<thead>
<tr>
<th>Age</th>
<th>&lt;1 year old</th>
<th>1 to 2 years old</th>
<th>2 to 5 years old</th>
<th>5 to 9 years old</th>
<th>9 to 14 years old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intoxication</td>
<td>10</td>
<td>22</td>
<td>54</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Bites</td>
<td>6</td>
<td>19</td>
<td>60</td>
<td>74</td>
<td>99</td>
</tr>
<tr>
<td>Stings</td>
<td>2</td>
<td>14</td>
<td>30</td>
<td>35</td>
<td>31</td>
</tr>
<tr>
<td>Foreign bodies</td>
<td>5</td>
<td>36</td>
<td>140</td>
<td>74</td>
<td>44</td>
</tr>
<tr>
<td>Traumas</td>
<td>126</td>
<td>192</td>
<td>566</td>
<td>617</td>
<td>875</td>
</tr>
<tr>
<td>Burns</td>
<td>2</td>
<td>13</td>
<td>21</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Drowning</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Intoxication was the fifth most frequent cause of accidents, and it also concentrated in the age group from 2 to 5 years old (49.5%). In this group, the intoxication by medications prevailed, while intoxication by domestic products prevailed in 1 to 2-year-old children. Children aged 1 to 2 years old, because of their cognitive development, act in a domestic restricted area, such as the kitchen or the laundry, thus they find cleaning liquids, paint containers, and other domestic products. Older children, on the other hand, interact with the environment and search for products in shelves, pots, and closed glass containers, with colored liquids and drops. Intoxication is a common event, and its importance is demonstrated in the annual involvement of two million American children younger than 5 years old.27

The idea that intoxication lesions are avoidable, while some traumatisms are not, and the existence of an elevated incidence of childhood intoxication, have led to a continuous effort for the prevention of intoxication. Some examples are: one-to-one education projects, community programs in the media, modification in the medicine wrappings, with inviolable lids, and flasks containing the total product dosage in a non-lethal concentration.

Burns did not have a significant representation in our sample (1.7%), and they were more common in 2 to 5-year-old children, due to the same reasons as those previously mentioned (at this age, children stay in the kitchen more often, and scalds become common). We recommend the pediatricians to collect data on the circumstances and products involved in burn lesions, to insist in prevention, and to cooperate with the local fire department in the implementation of preventive orientation.

Drowning and near-drowning had low incidence in our study, but they present high mortality.

The child who is victim of an accident can only be ideally treated if the health system to which he/she turns to is prepared for the adequate treatment of lesions resulting from accidents. Frequently, the child who is victim of traumas looks for services that do not make part of a well-organized health system, and he/she is usually referred to a tertiary hospital due to absence of resources in the care unit, or due to insecurity and inability of the health personnel who assist him/her. The need for the decentralization of assistance is evident; still, in order to be satisfactory, our care system requires trained teams who are oriented by standardized conduct protocols, besides health centers of easy access.28 The inclusion of care routines in the strategy of Atenção Integrada às Doenças Prevalentes da Infância - AIDPI (Integrated Attention to Childhood Prevaling Diseases) would be significantly important.

Long ago, pediatricians noticed the need for advising in the prevention of accidents. This prevention has to be frequent, serious, and practicable. There must be priorities out of which we can create strategies, based on legislation and regulations, since it is known that parents from several socioeconomic and geographic groups have significant educational deficiencies regarding the prevention of accidents. We must stress the pediatrician’s responsibility in informing and being informed, in practicing the prevention of accidents, and in influencing those who make products and laws.

We should once again remember that children, in their diverse stages of development, present different traumas, and this is fundamental for the definition of efficient prevention programs. The concept of the child’s behavioral development, and the characteristics of each stage may be

Table 7 - Clinical evolution of victims of accidents who received care at the Pediatric Emergency Room from March 1997 to February 1998

<table>
<thead>
<tr>
<th>Evolution</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical examination and discharge</td>
<td>1,418</td>
<td>44.1</td>
</tr>
<tr>
<td>Post-treatment discharge (&lt;12 h)</td>
<td>1,465</td>
<td>45.6</td>
</tr>
<tr>
<td>Post-treatment discharge (&gt;12 h)</td>
<td>66</td>
<td>2.0</td>
</tr>
<tr>
<td>Observation in the Emergency Room (12-36 h)</td>
<td>165</td>
<td>5.1</td>
</tr>
<tr>
<td>Observation in the Emergency Room (&gt;36 h)</td>
<td>9</td>
<td>0.3</td>
</tr>
<tr>
<td>Admission to Pediatric Nursery*</td>
<td>69</td>
<td>2.1</td>
</tr>
<tr>
<td>Admission to Intensive Care Unit*</td>
<td>20</td>
<td>0.7</td>
</tr>
<tr>
<td>Deaths</td>
<td>4</td>
<td>0.1</td>
</tr>
</tbody>
</table>

* Median hospitalization time (Pediatric Nursery + Intensive Care Unit): 8 days.
extremely useful for parents and also for doctors. Besides that, the communication with parents about physical and cognitive limitations that are specific to these age groups may help in the elaboration of clear safety rules, which would avoid a series of unnecessary risks.

Acknowledgments
This work was supported by CNPq.

References

Correspondence
Dr. Emílio Carlos Elias Bacarat
Rua Doutor Lauro Pimentel, St. 303
CEP 13083-250 Campinas, SP, Brazil
Phone: +55 19 287.5479 – Fax: +55 19 287.7123