

## Epidemiology of burns in hospitalized children from the Western Pomerania region in Poland in 1985-2010

Brodzińska B.\*<sup>A,B,C,E,F</sup>, Czaja-Bulsa G.<sup>D,E,F</sup>, Marasz A.<sup>D,E,F</sup>, Musiał B.<sup>D,E,F</sup>

Department of Paediatrics and Paediatric Nursing, Pomeranian Medical University in Szczecin, Poland

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### ABSTRACT

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**Introduction:** Burns in children are a serious public health issue all over the world. This paper aims at comparing the frequency and causes of burns in children.

**Material and methods:** A retrospective analysis of medical records of 1230 children treated at Szczecin's burns centre in 1980s and presently was carried out.

**Results:** We have noted that at present hospitalization frequency of burned children has declined 1.7 times. Children who undergo hospital treatment are mostly aged 1-2 (ns) and boys prevail 1.7 times. Infants constitute a high percentage of burn patients (15% and 17%). A proportion of countryside children has decreased (38% vs 28%;  $p < 0.001$ ) while a proportion of town children has increased. Skin burns most frequently resulted from

contact with hot liquid (89% vs 83%;  $p = 0.043$ ). The other causes have been noted far less frequently: flame (7% vs 8%; ns), electric current (1% vs 2%; ns), chemicals (0,7% vs 1%; ns) and a few other factors such as: dry heat, sunrays and solarium (2% vs 5%;  $p = 0.002$ ).

**Conclusions:** 1. Over the course of the past 25 years, Western Pomerania has seen a twofold decrease in the frequency of hospitalization of burned children, while the ages and causes of burns have remained the same. 2. Those most often treated are children aged 1-2, mainly boys; there is a high percentage of infants among them. 3. Hot liquid has remained the chief cause of burns in younger children; in the case of older ones, so is flame.

**Keywords:** Burn, children, Poland

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### Corresponding author\*

Beata Brodzińska, Pomeranian Medical University in Szczecin  
Department of Paediatrics and Paediatric Nursing  
ul. Żołnierska 48, 71-210 Szczecin, Poland  
e-mail: musialb@wp.pl

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## INTRODUCTION

Globally, burns constitute a serious problem for public health in terms of physical, psychological and economic consequences. The related post-traumatic shock and a possibility of developing burn disease, scars and body deformations as well as a long-lasting disability need specialist therapy and multi-dimensional rehabilitation.

Burns occur frequently and involve approximately 1% of global population each year [1]. A total number of burned children is unknown. In Poland certain research centres report the numbers of burned children, yet there is no comprehensive epidemiological data describing the problem of nation-wide scope.

It is believed that burns constitute a third cause of deaths in child population, following traffic accidents and instances of drowning [2].

According to the 2004 WHO report, in low-income countries children suffering from burns face a tenfold higher death rate than the ones in high-income countries [3].

Burns most frequently concern the youngest children, up to 3-5 years of age [4].

They mostly occur at home – in the kitchen – and result from lack of proper adult supervision [5].

Little children are curious of the world, naturally active and being unaware of risks, they explore a new environment through touch and thus are prone to burns. Most frequently (in 80% cases) skin burns in children are mild to moderate and the remaining 20% are severe burns [6].

Purpose of this study was to compare of frequency and causes of the burns in children at the turn of 25 years (1985-2010).

## MATERIALS AND METHODS

Medical records of patients hospitalized due to skin burn at the Child Surgery Ward with the Sub-Department of Urology and Burns Therapy of Children's Hospital at ul. Wojciecha 7 in Szczecin were analysed retrospectively. The institution is part of “Zdroje” Independent Public Healthcare Centre and it is the only child burn centre in West Pomeranian region.

The study included 1230 children aged between 28 days and 17 years old, that lived in West Pomeranian region. The first group consisted of 710 children treated in the 1980s for a period of four years (1985-1988) and the second group – 520 patients treated for 5 years in the beginning of the XXI century (2006-2010).

The analysis took the following aspects into account:

- child's age at the moment of the accident; children were divided into 6 groups: up to 1 year old, 1.1-2 years old, 2.1-3 years old, 3.1-7 years old, 7.1-11 years old, 11.1-17 years old. (table 1);
- child's gender – in 1985-1988, 453 boys and 257 girls were treated; in 2006-2010, 323 boys and 197 girls were treated;
- type of thermal factor which caused a burn (hot liquid, flame, contact, electric, chemical burn)

**Table 1.** Number of children in relation to age in the studied periods

Age (years)	1985 – 1988 n=710	2006 – 2010 n=520
0.0 - 1	107	89
1.1 - 2	332	266
2.1 - 3	86	33
3.1 - 7	132	45
7.1 - 11	35	33
11.1 - 17	18	54

### Data analysis

The obtained data were stored in electronic form in an EXEL database, subjected to statistical analyses were carried out with STATA 11 software.

Normal distribution of continuous variables was verified using the Kolmogorov–Smirnov test. Discontinuous variables were

described through the quantity and frequency of incidence.

Correlations between them were assessed with the use of the Pearson's chi-square test or the exact Fisher's test. In all the conducted tests statistically significant differences were the ones for which probability p was lower than 0.05 (p<0.05).

## RESULTS

### Demographic data

In 1985-1988, an average of 177 children (167-183 children) were hospitalized annually in West Pomeranian region. In 2006-2010, the number was on average 1.7 times lower, amounting to 104 children (90-115 children).

In 1985-1988, an average of 310 277.5 children resided in the West Pomeranian region and annually on average 0.057% children were hospitalized on account of skin burns. In 2006-2010, 347 812 children resided in the area; annually two times fewer number of children were hospitalized due to skin burns – 0.029% on average.

In 1985-1988, it was countryside children who most often suffered from burns in Western Pomerania (38%) (table 2). Nowadays, burns occur the least often in this group of children (38% vs 28%;  $p=0.0005$ ). Throughout the years the incidence of skin burns has increased among children residing in Szczecin (32% vs 37%; ns).

Only children and those who had just one sibling were most frequently subject to burns. A downward trend in the incidence of burns was observed in relation to children born in large families ( $p=0.001$ ).

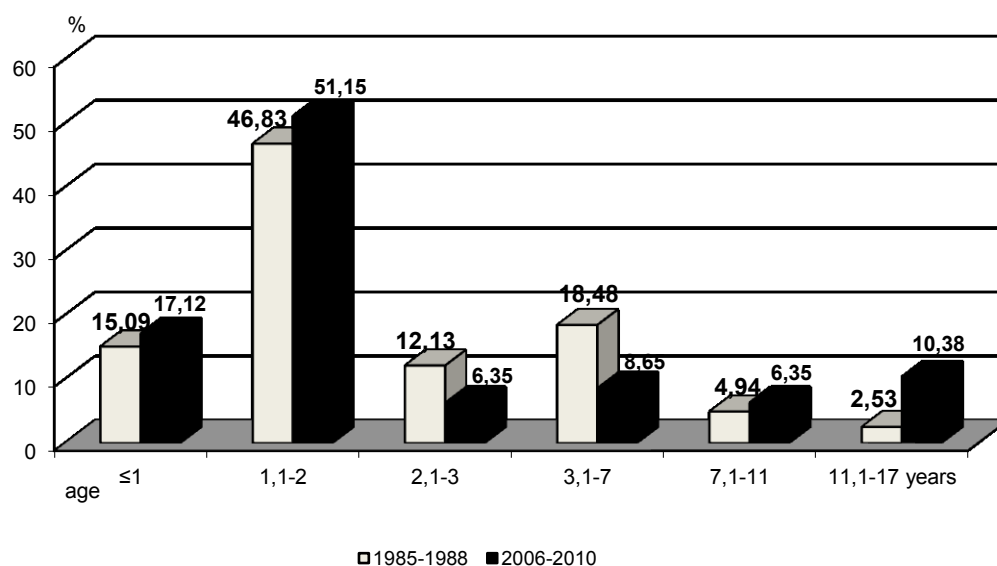
In both studied periods, the most often hospitalized children were aged between one and two years old ( $p=0,001$ ) and – three times less often – infants (15% vs 17%; ns) (Figure 1).

Children of up to 3 years of age have always accounted for 74% of those hospitalized. Older children were seldom subject to hospitalization. However, over the course of 25 years a fourfold increase in hospitalization frequency was noted among the oldest children of 11.1-17 years old (2.5% vs 10%,  $p<0.001$ ).

In both study groups girls-boys ratio was the same ( $p=0.557$ ), boys prevailed 1.7 times. The greatest number of prevailing boys was observed in the group of the oldest children, where they accounted for 94% in 1985-1988 and 74% in 2006-2010

**Table 2.** Place of residence of children included in the study (\*Szczecin – 400 000 residents)

Place of residence	1985-1988		2006-2010	
	%	n	%	n
Szczecin*	32.30	230	37.31	194
Small towns	29.48	209	35	182
Countryside	38.22	271	27.69	144



**Figure 1.** Ages of children hospitalized due to skin burns in the studied periods

### Aetiology

In both study groups the most common cause of skin burns was hot liquid (89% vs 83%;  $p=0.043$ ). Other causes were indicated far less

often: flame (7% vs 8%; ns) electric current (1% vs 2%; ns), chemicals (0.7% vs 1%; ns) and a few other factors such as: dry heat, sunrays, solarium (2% vs 5%;  $p=0.002$ ) (Figure 2).

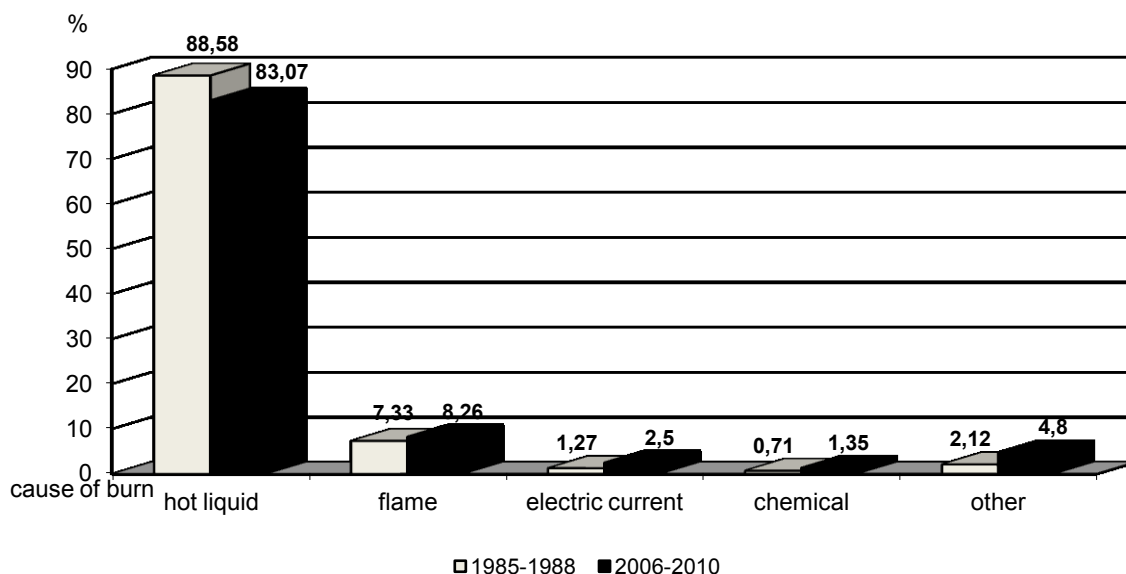


Figure 2. Causes of skin burns in the studied periods

In 1985-1988, the prevalent cause of skin burns in children up to 11 years old was hot liquid ( $p < 0.001$ ) (Figure 3).

In children up to 3 years old the percentage of those burnt with hot liquid amounted to 90%-95%, and in those aged between 3 and 7 – 85%. It systematically declined in older children and in the

oldest ones (11-17 years old) it the percentage was 33%. A reversed trend was observed in the case of burns caused by flame – in 2-year-olds the percentage of burn incidence slowly grew and in those aged 11+ flame was the most common cause of burns (56%). Other factors seldom brought about skin burns – most often in children aged over 11 (6%).

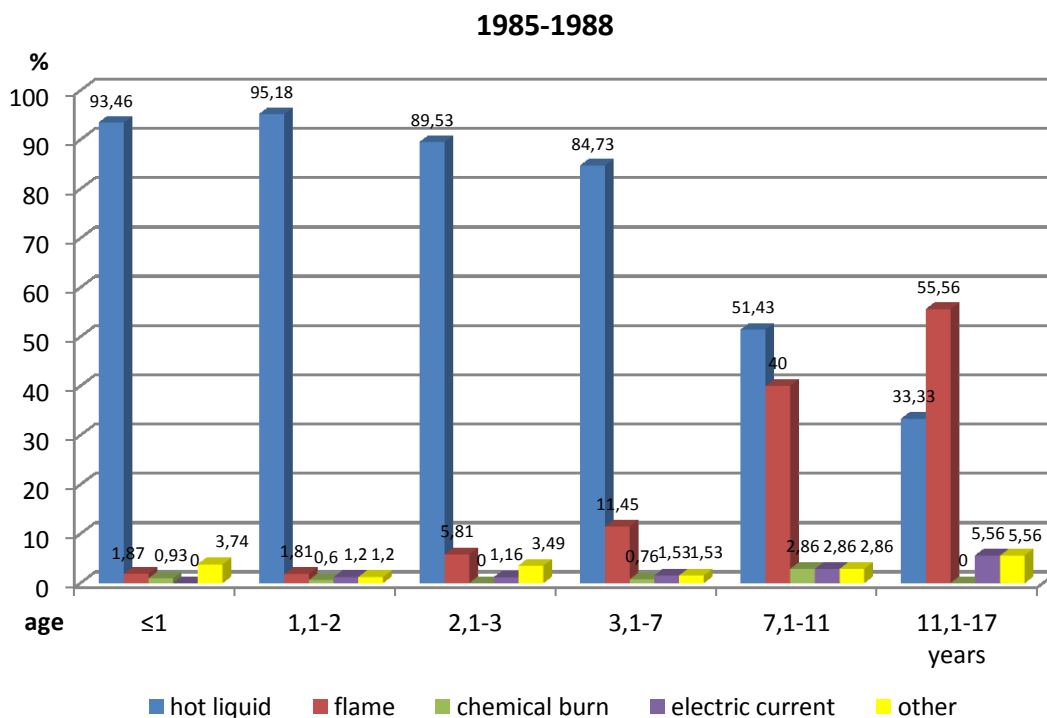


Figure 3. Causes of skin burns with regard to the ages of children hospitalized in 1985-1988

In 2006-2010, hot liquid was the main cause of burns in all age groups (Figure 4). In children of up to three years of age it was responsible for 90%-97% burns. In those aged 3+ a decrease was observed in the incidence of skin burns caused by hot liquid – in the case of the oldest children it was responsible for 35% of burns. The second most common cause of burns was flame. The frequency of these burns increased in children who were over three years old. In those aged between 3.1 and 7 years flame was responsible for 9% of burns and in the case of older children – for a third of burns. It was mainly the oldest children who suffered burns due to electric

current (17%). Burns due to the so- called other factors occurred mostly in infants (8%) and in children aged 7+ (15% and 13%). In all the age groups chemicals proved to be the rarest cause of skin burns.

No statistically significant differences were found regarding the frequency of causes of skin burns in the selected age groups in children hospitalized between 1985 and 1988 and between 2006 and 2010. The only significant difference was a higher frequency of burns caused by the so-called other factors, which was observed in children aged 1.1-2 years hospitalized in 2006-2010 (1.2% vs 4.1%; p=0.022).

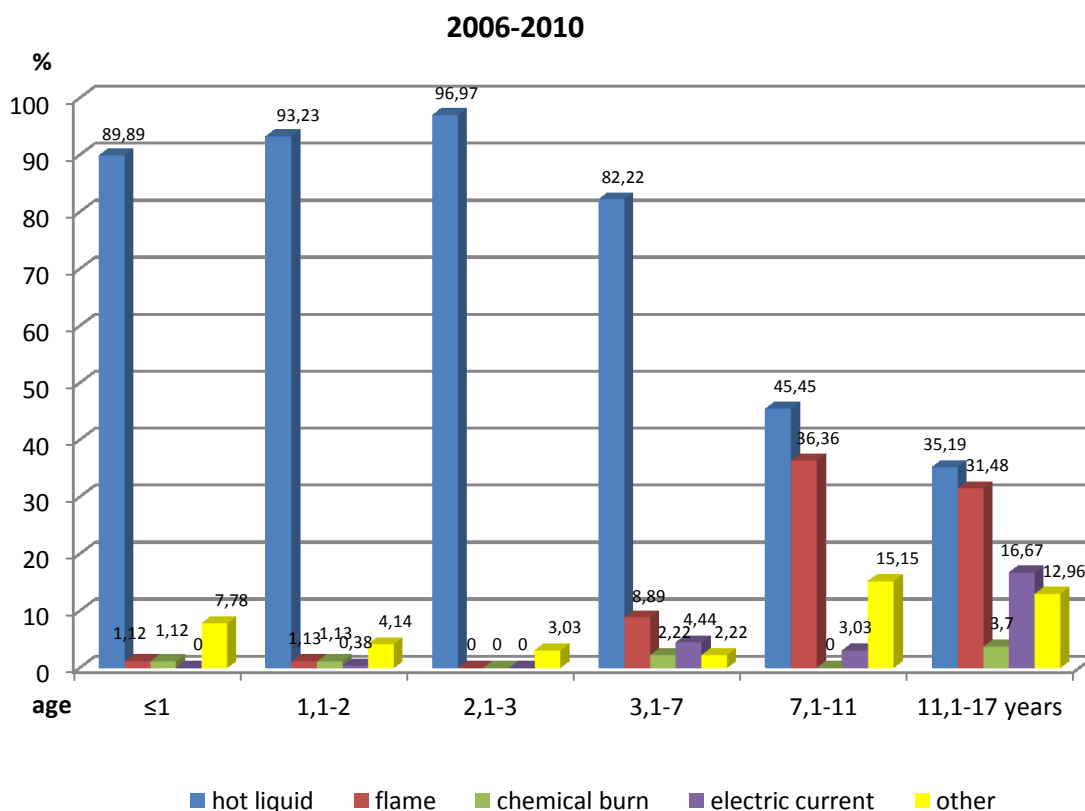


Figure 4. Causes of skin burns with regard to the ages of children hospitalized in 2006-2010

## DISCUSSION

There is none national system for registering patients hospitalized on account of burn injuries among children [11]. Partial information is found in works of individual researchers. In the United States the situation is different, as there is a functioning country-wide register of burn patients. Thanks to such registration system, data are collected from all the burn centres, in order to carry out epidemiological monitoring, improve regional planning of health care of those severely burned as

well as to enhance prevention efficiency. Reports made by the National Burn Repository (NBR) also contribute to sharing clinical experience among burn centres all over the world and help improve the quality of scientific research [7]. The studies presented in this paper are obtained from the only centre in the West Pomeranian Voivodeship specializing in treating burns in children. There are few such centres in Poland, therefore certain cases are treated at regular child surgery wards.

Gradual decrease in the number of burned children has also been observed over the years.

Throughout the past two decades Western Pomerania also saw a 52% drop in the frequency of hospitalizations of children with skin burns. In 1985-1989, it numbered 57.2/100 000 children, whereas in the period from 2006 to 2010 it fell to 29.9/100 000. Similar trend is described by other authors [8, 9].

In the researched material it was the place of origin of the burned children which significantly differed. In 1985-1988 there were more accidents among countryside children, whereas these days the greatest number of burned children come from the region's capital – Szczecin (400 000 residents). In the analysed material one must not overlook the crucial fact that the largest number of burns occurred in families with one or two children and the more children in the family, the fewer injuries were recorded. It shows that in families with greater number of children parental supervision is not less intensive.

An analysis of results of burned children from West Pomeranian region has proved that boys had nearly twice as many burn incidents as girls. In this period, boys' birth rate compared to girls' birth rate was in fact slightly higher, yet the difference was small. In 1985-1988 in the West Pomeranian Voivodeship on average 2.73% more boys were born than girls and in 2006-2010 – 2.52% more boys.

Apparently the higher incidence of burns in boys is related to their hyperactivity and curiosity. The results we obtained are consistent with the other authors' reports [10, 11]. In other papers the authors also report that boys account for 75% of burned children.

For years, in overall children population, the percentage of burns in the youngest children has remained at a similar level.

In both studied periods, in Western Pomerania infants accounted for 15% - 17% of the burned children. Compared to the results found in other publications, the percentage is high indeed. The 5-year observation conducted by Turkish researchers indicates a lower frequency of burned infants, reaching 5.48% [12]. In a corresponding period of time (5 years), even fewer infants (3%) were found among burned children in Finland [13]. Findings presented in the prepared material are similar to those obtained by other Polish authors. Matuszczak et al. in their paper published in 2011 reported that in Białystok infants constituted 15.4% of the burned children [14]. Results of earlier studies conducted in Kielce – 1990s – published by Mierzwa et al. show a high percentage of burned infants as well (15.15%) [15].

A high percentage of infant burns recorded in Poland may be a symptom of low level of knowledge and awareness among youngest children's parents/care givers and it calls for propagating knowledge in this regard. It is all the

more important as infant burns mainly occur in domestic environment.

According to our own study, in both of the examined periods, children up to 3 years old accounted for 74% of those burned. Similar results are found in Zhu et al., who studied children from northern provinces of China for ten years – a percentage of burns in children aged up to three reached approximately 70% [16]. However, a study conducted by Iranian noted there were much fewer representatives of this age group – only 26% of those burned [17].

At school age the burn rate is significantly reduced. According to our own research, a percentage of burned children over 7 in both study groups was 5-6%. Similar results were reported in studies by Owczarek et al. carried out in Łasko – a percentage of school children accounted for 10% of all burn patients [18].

In the World one of the most common causes of burns in children is hot liquid (60-75% of all hospitalized children), contact burns constitute 13-47%, and flame burns occur in 2-5% [5, 19, 20, 21, 22].

Results of our studies are consistent with international patterns, and, irrespective of the period of time of research, the overwhelming majority of burns in the hospitalized children was due to hot liquid. The remaining factors rarely brought about skin burns. The commonest of them was flame, the rarer one – electric current and the rarest one – chemicals.

Burns related to hot liquid in both analysed groups mostly involved the youngest children. The older the patients were, the less frequent this type of burn was. Inverse correlation was observed in the case of flame burns, where the frequency increased with age. Literature indicates that in children aged 6+, frequent causes of burns involve fires or explosions created by children themselves. In the case of adolescents, burns are associated with risky behaviour, acts of criminal nature or, less often, attempted suicide [23-25].

Even though scalds occur at all ages, they mostly happen to the youngest children. In Sweden hot liquid is the cause of as much as 80% of burns in children aged up to 4 [26]. Iranian authors, who analysed the history of 870 children under 15, found that scalds related to 68% of those studied and the frequency decreased with age. Flame burns accounted for 24.5% cases, their frequency increased with age and they mostly occurred in the oldest children – between 10 and 14. Electric current, contact and chemical burns were seldom diagnosed, in 4.8%, 2.2% and 0.3% of children, respectively [17]. Similar results were presented by Ortiz et al., who analysed children hospitalized in Madrid. They revealed that the youth, who constituted 8.8% of the group of burn patients, suffered chiefly from flame burns (65%). This type



of burn most often leads to severe skin damage. According to this study, in 83% children surgical treatment was administered [27].

However, studies carried out in 2004-2008 in Lagos, Nigeria, show different results. There is a high percentage of infants – as much as 40% – and the commonest cause of burn was flame (in 66.4% children) [28].

Australians from a Sydney hospital draw attention to the increasing number of contact burns in children (30.5%) and, at the same time, they emphasize the need for taking preventive actions in this respect [29]. An even higher percentage of this type of burns (36%) was mentioned by Rawlins et al. [30].

## CONCLUSIONS

1. Over the past 25 years Western Pomerania saw a twofold decline in the frequency of hospitalizations of burned children.
2. Most often those treated are children aged 1-2, boys twice as often, and there is a high percentage of infants.
3. A percentage of hospitalized countryside children has significantly decreased while a proportion of town children has increased
4. In the case of infants and younger children, hot liquid remains the chief cause of burns, and in older children – so is flame.

## Conflicts of interest

We declare that we have no conflicts of interest.

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