

CHILDREN DEATHS BY FALLING FROM A HEIGHT EPIDEMIOLOGICAL AND CAUSAL CIRCUMSTANCES

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Abstract

Children deaths by falling from a height have an important role in traumatology of this population category.

Key words: child, trauma, height

INTRODUCTION

Most deaths by falls from height were recorded in weekends, with a total of 38 cases, accounting for 65.51% of all deaths. This finding correlates with greater freedom of movement of children in weekend, with departures in hazardous locations in terms of the modality of falling from a height and engagement in games unsuited to age.

MATERIAL AND METHOD

During 2003-2014 Legal Medicine Department Bihor performed and recorded a number of 58 necropsies of dead children by falling from a height. This represents 6.39% of all injuries by falling from a height recorded in the reference decade. We studied the clinical documentation of cases hospitalized before death, autopsy protocols, official reports filled at the scene, and those with a wider social or criminal impact.

RESULTS AND DISCUSSION

Most deaths by falls from height were recorded in July (15.52%), followed by August (13.79%) and June and September with 12.07% each.

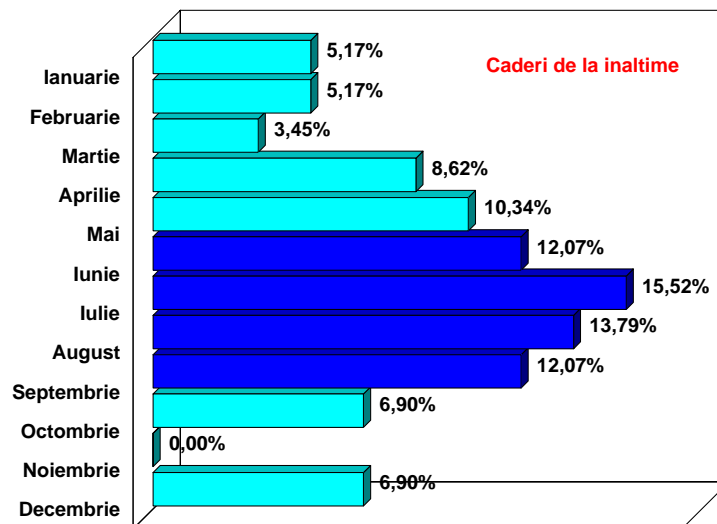


Figure 1 Monthly distribution of deaths

Highest lethality was recorded in February (10.71%) followed by April (9.62%) and October (2.55%).

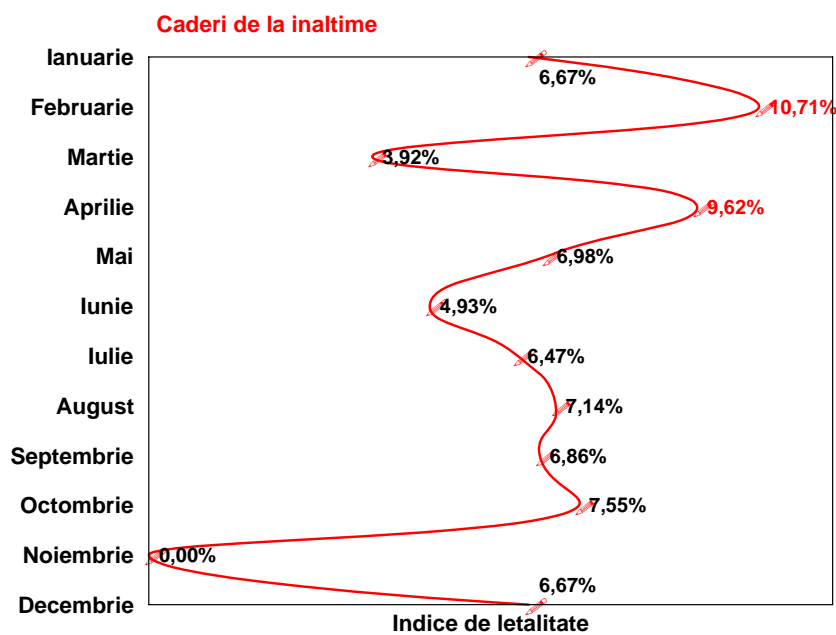


Figure 2 Evolution of the lethality by months

Most deaths were recorded in summer (39.66%) and spring (22.41%), and the least in winter (17.24%).

The highest lethality index was recorded in winter (7.52%), slightly greater than in the spring (6.88%) ($p = 0.167$), but significantly higher than in the summer (5.85%) ($p = 0.001$) and autumn (6.25%) ($p = 0.019$).

Table 1

Seasonal distribution of deaths by falling from a height in minors

Season	No. of deaths	%	Lethality index (%)
Winter	10	17,24	7,52
Spring	13	22,41	6,88
Summer	23	39,66	5,85
Autumn	12	20,69	6,25

Prevalence of trauma resulting in death is highest in July and it is followed closely, in that regard, by the other summer months. This is a finding also reported in other types of trauma as traffic accidents or falls from the same level. In these months the children are on holiday and very often they leave their home area, moving around in gardens, parks, rural areas, they are traveling outside settlements in hazardous areas with rough terrain. Supervision is lax or lacking. It should be emphasized that in these months there is a minimum incidence of injuries by falling from a height, so, although there are relatively more deaths, lethality index is lower compared to other seasons (5.85%). The absolute number of deaths is lower in the other three seasons and no statistically significant difference between them are noticed, but the correlation with the total number of injuries in the same season makes the lethality index values to be higher than in the summer.

Highest mortality rate was recorded on Sunday (9.80%) followed by Mondays (9.52%), while the lowest was recorded on Thursday (3.41%).

Table 2

Weekly distribution of deaths and mortality falls from height in minors

Weekday	No. of deaths	%	Lethality index (%)
Monday	6	10,34	9,52
Tuesday	4	6,90	4,35
Wednesday	7	12,07	5,88
Thursday	3	5,17	3,41
Friday	13	22,41	6,07
Saturday	15	25,86	6,55
Sunday	10	17,24	9,80

These indicators are dependent on the fact that the total number of injuries by falling from a height is much lower in the first days of the week, so that even fewer deaths may impose high lethality index.

The most frequent time interval in which deaths occurred was 14 to 22 which is 72.41% of all deaths. Is followed by the interval 6-14 with 22.41% of the deaths.

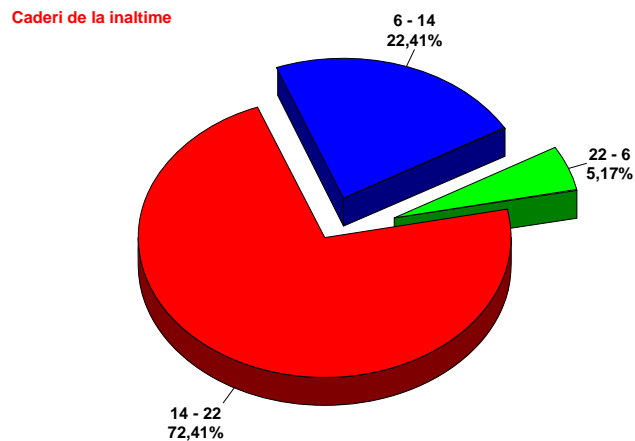


Figure 3 Hourly distribution of deaths by falling from a height that involves minors

Trying to correlate the deaths with the height of falling, we divided this interval as it follows: 1-5 m, 5-10 m and > 10 m. Half of the deaths occurred in children who fell from a height between 5 to 10 meters.

Table 3

Distribution of deaths according to the height of fall victim

Height of falling	No. of deaths	%	Lethality index (%)
1-5 m	11	18,97	1,35
5-10 m	29	50,00	42,65
> 10 m	18	31,03	81,82

The lethality index is correlated with the height of falling, increasing proportionally with that. Thereby, lethality index was 1.35% for heights below 5 m, 42.65% for the 5 to 10 m interval, and 81.82% for heights over 10 m. Risk of death in children suffering injuries from falls from height is 18 times higher in a fall of over 10 m (RR = 18,102 and RA = 0.773).

We analyzed the distribution of deaths accordingly to the place where the fall occurred. Most deaths was recorded in children who fell from the window/balcony (24.14%), followed by stairwells, stairs/ladders (17.24%) and attic or tree (15.52%).

Lethality Index was highest for the fall from the various columns/walls (40.00%), on the stairs/stairwells (34.48%), roof (26.67%) and attic (20, 00%). There is a correlation with the height from which the fall happened (there are the same number of deaths from falling off the roof, attic or tree, but the lethality index is two or three times lower in the tree falls compared to other places to produce the fall).

Table 4

Distribution of deaths correlated with the place of falling

Place of falling	No. of deaths	%	Lethality index (%)
Window/balcony	14	24,14	8,97
Stairs	10	17,24	34,48
Roof	8	13,79	26,67
Attic	9	15,52	20,00
Toboggan	1	1,72	3,45
Tree	9	15,52	9,09
Collumn/Wall	4	6,90	40,00
Ravine	3	5,17	3,95

The next goal was to correlate the place where the victim has fallen with the distribution of consequences.

Most deaths occurred due to fall in the street (20.69%), followed by those in the rural area (18.97%) and flat or garden (17.52%).

The high lethality index was 60% for falls from height in the street.

In these cases intervene both the height of the fall of the victim and the nature of the contact surface. Falls in the street happens usually from apartment windows, sometimes very tall buildings, but from the roof of houses and bridges, also. On the other hand, the streets are paved with asphalt, stone, tiles of great hardness with devastating impact.

Table 5

Distribution of deaths according to the place of the fall of the victim

Place of the fall	No. of deaths	%	Lethality index (%)
Apartaments	10	17,24	4,26
Trips out of town	11	18,97	5,56
Garden	10	17,24	5,08
Backyard	9	15,52	5,49
Park	3	5,17	6,00
Kindergarden	1	1,72	6,67
Gym	2	3,45	7,14
Street	12	20,69	60,00

Nature of the contact surface has an important role in the occurrence of deaths. Most deaths were caused by falls from height on the soil (43.10%), followed by those on cement, asphalt (32.76%).

But lethality index is 50% for the falls on stone, 20% for the fall on tile and 14.73% for those on concrete. Although the number of traumatized children by falls on the ground remains the majority, situation in which most of the deaths were recorded (43.10%), rate of fatal crashes on the ground is only 6.02%

Table 6

Distribution of deaths correlated to the impact surface

Impact surface	No. of deaths	%	Lethality index (%)
Ground	25	43,10	6,02
Concrete	19	32,76	14,73
Stone	7	12,07	50,00
Pile	1	1,72	9,09
Ice	1	1,72	4,17
Tile	3	5,17	20,00
Floor/parquet	2	3,45	0,98

It is important to establish the context of occurrence of a fall from height. Thereby the fall may involve a child at rest or a moving child. A child at rest may swerve when is suddenly shouted at, threatened or is pushed accidentally or intentionally. A moving child, who is running in a room with open windows, balconies, or running in an attic or roof of the house, running over rough terrain, by the edge of a ravine, and may be careless stepping empty and tumbles. Most deaths were caused by falls from moving, running (77.59%). Lethality index is only 1.86% in the case of deaths result of falls from rest, but it is 21.63% for falls from moving.

Tabel 7

Distribution of deaths related to the context of the fall

Context	No. of deaths	%	Lethality index (%)
Child at rest	13	22,41	1,86
Moving/running	45	77,59	21,63

In terms of how the falls occurred there were 49 deaths by free falling and 9 deaths by sliding on inclined surface. So 84.48% of deaths were produced by free fall, fall on the slope being rare (slide, steps, steep slopes).

No significant differences between the index of lethality by free fall or slip on the slope were recorded (6.38 vs 6.47%) ($p = 0.887$).

It is extremely important to establish the circumstances of the fall resulting in death occurrence.

In almost half the cases (48.2%) lethal falls were the result of children own mistakes: haste, inattention, disobedience, eronate assessment of the buildings they climbed and where they fell, inability to appraise the heights and the risks.

In 15.52% of cases, the child was accidentally pushed by other persons during the game, rarely intentionally, by an irresponsible playmate as himself. There were cases when the collision of two children lead to fall of both.

Another category is the falls as a result of events that are more or less unpredictable, at least from the point of view of the child (10.34%). Here are the quotes: the collapse of balconies, of roofs or bridges, breaking of branches of trees, the sudden occurrence of storms with high wind speed that unbalanced children.

Adult role can not be ignored: 86.21% of deaths occured as a result of accidents that involved unsupervised children.

If lax oversight is partly understandable among schoolchildren and adolescents, lack of supervision of children 1-3 years and 4-6 years is absolutely inexcusable.

Of the four cases of attempted suicide, three cases led to death, realising a lethality index of 75%.

Table 8

Death distribution related to circumstances of falling

Circumstances	No. of deaths	%	Lethality index (%)
Own mistakes	28	48,28	4,97
Pushed child	9	15,52	4,79
Environmental events	6	10,34	17,65
Adult mistakes	11	18,97	9,73
Criminal context	1	1,72	20,00
Suicide	3	5,17	75,00

Medical causes of deaths were due to head injuries with a major prevalence of 55.17%. In order of frequency it was followed by polytrauma, with a prevalence of 32.76%. Have also been reported chest trauma (sternal fractures and aortic ruptures), hemopneumotorax, multiple rib fractures with lung injury) 5.16%, spinal injuries (fractures of the spine) 1.72%, abdominal trauma (ruptured liver, spleen, kidney) 5.16%.

Table 8

Distribution of cases by falling from a height related to the medical cause of death

Cause of death	Nr. of cases	%
Head trauma (skull fracture, subdural hematomas, brainstem lesions and brain dilacerations)	32	55,17
Chest trauma (sternal fractures and aortic ruptures, multiple rib fractures, lung injury)	3	5,17
Spine fracture	1	1,72
Abdominal trauma (liver, spleene, kidney rupture)	3	5,17
Polytrauma	19	32,76
Total	58	100,00

At a rate of 86.21% children died instantly or survived less than an hour. In the next 23 h died 6.93% of traumatized children, survival did not exceed one day in 93.18% of cases. Only two cases have survived 1-2 days (3.45%), and two cases slightly exceeded this range (3.45%). These situations were represented by the traumatic brain injury with prolonged coma or polytrauma.

CONCLUSIONS

Deaths by falls from height have a multiple determinism and confounding circumstances of occurrence, and the responsibility is more difficult to identify and reasoned. Complex analysis of these cases is extremely important, whenever possible, because often it can provide references that allow to structure a real plan to prevent and combat this devastating phenomenon.

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