

# PEDIATRIC POISONINGS IN A ROMANIAN CHILDREN HOSPITAL: AN EPIDEMIOLOGICAL RETROSPECTIVE REPORT

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## Abstract

Background and aim: Intoxications continue to present a challenge for clinicians in Romania, due to the extremely diverse range of toxins that can be involved, as well as the limited treatment options and specific antidotes available. Our objective was to perform an epidemiologic analysis of patients with intoxications from a Romanian emergency hospital. Methods: We analyzed the pediatric intoxications from The Regional Pediatric Toxicology Centre, part of The Emergency Clinical Children's "Louis Turcanu" Hospital from Timisoara, Romania. We focused on the Pediatric Emergency Department (PED) giving a longitudinal account of intoxication cases between the 1st of January 2008 and the 31st of December 2011. Results: In this time frame the Pediatric emergency department - PED had 76 223 visits, out of which 717 were acute intoxication cases. 60.4% were accidental. 89.4% of the voluntary intoxications were part of the 12-17 year olds group. While teenage females mainly ingested prescription drugs (67%), teenage males chose ethanol (71%) and illicit drugs (66.7%). The rural population is slightly more prone to accidental intoxication. Prescription drugs were the most common cause of voluntary intoxication observed in the PED, with n=247 (34.4%) cases reported in the 4 year period. The second most common cause of this category was illegal substance use, with n=63 (8.8%) cases reported. An altered mental state was observed in n=46 (6.4%) of patients during the first medical evaluation. Discussions and conclusions: In spite of the steady 1% proportion of pediatric intoxications in relation with total PED visits, there has been a shift in substance preference, especially among teenagers. Alcohol remains popular, but it has seen a slowing trend, with the void being filled by new "legal highs".

**Keywords:** pediatric poisoning, children, intoxication.

## Introduction

Intoxications continue to present a challenge for clinicians in Romania, due to the extremely diverse range of toxins that can be involved, as well as the limited

treatment options and specific antidotes available. The potential threat posed to pediatric patients is amplified by the often unpredictable nature of the event, combined with the particular characteristics of children's health care and the limited information that can be gathered from a patient's history (1).

In the context of an increasing amount of new substances surrounding us (both natural and synthetic) due to industrial development and better market access, we decided to take a look at the pediatric intoxications from The Regional Pediatric Toxicology Centre, part of The Emergency Clinical Children's "Louis Turcanu" Hospital from Timisoara, Romania (2). Our objective was to perform an epidemiologic analysis of patients with intoxications from the local Emergency Pediatric Centre, in order to assist both clinicians treating acute intoxications and hospital administration in regards to patient management and policy making (3, 4).

## Material and methods

**Hospital ethics committee approval was obtained before beginning the study:** Informed consent clearly indicating that patients have given their informed consent for participation in the research study was obtained by signing the paperwork at admission in hospital.

**Design:** We performed a retrospective study assessing children with acute intoxications addressed to a university hospital.

We included all patients evaluated for acute intoxications in The Emergency Clinical Children's "Louis Turcanu" Hospital from Timisoara, Romania between the 1st of January 2008 and the 31st of December 2011.

**Analysis of data:** We analyzed the records of the patients evaluated in the two main areas of the hospital that deal with intoxications, the Pediatric Emergency Department (PED) as the point of first contact between a health-care provider and the patient, and the Pediatric Toxicology Ward (PTW) as the end point for the more demanding cases that require further medical treatment.

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Frequency	Type		Place		Patient's Sex		Coma		Admitted		Total
	A	V	R	U	F	M	No	Yes	No	Yes	
2008	80	77	59	98	85	72	141	16	75	82	157
2009	119	49	56	112	91	77	156	12	78	90	168
2010	113	59	49	123	80	92	167	5	66	106	172
2011	121	99	92	128	113	107	207	13	57	163	220
<i>Total</i>	433	284	256	461	369	348	671	46	276	441	717

A=accidental, V=voluntary, R=rural, U=urban, F=female, M=Male

**Table 1.** PED intoxications by year

Frequency	Type		Place		Patient's Sex		Coma		Admitted		Total
	A	V	R	U	F	M	No	Yes	No	Yes	
0-30 days	8	0	6	2	5	3	8	0	0	8	8
1-6 months	26	0	15	11	9	17	24	2	6	20	26
7-12 months	25	0	10	15	15	10	25	0	11	14	25
1-2 years	171	1	68	104	92	80	171	1	67	105	172
3-5 years	107	4	35	76	51	60	107	4	47	64	111
6-8 years	30	4	16	18	17	17	32	2	15	19	34
9-11 years	25	15	16	24	21	19	38	2	20	20	40
12-14 years	13	92	35	70	56	49	91	14	34	71	105
15-17 years	18	162	53	127	96	84	160	20	65	115	180
>18 years	10	4	2	12	7	7	14	0	10	4	14
unknown	0	2	0	2	0	2	1	1	1	1	2
<i>Total</i>	433	284	256	461	369	348	671	46	276	441	717

A=accidental, V=voluntary, R=rural, U=urban, F=female, M=Male

**Table 2.** PED intoxications by age

Frequency	Type		Place		Patient's Sex		Coma		Admitted		Total
	A	V	R	U	F	M	No	Yes	No	Yes	
<i>Drugs (prescription)</i>	14 3	10 4	84	16 3	16 6	81	23 5	12	83	16 4	247
<i>Alcohol</i>	10	11 7	37	90	36	91	10 6	21	80	47	127
<i>Drugs (illicit)</i>	0	63	15	48	21	42	58	5	9	54	63
<i>Volatile substances</i>	56	3	26	33	30	29	59	0	17	42	59
<i>Detergents &amp; Soaps</i>	49	0	16	33	26	23	49	0	23	26	49
<i>Carbon Monoxide (CO)</i>	37	2	15	24	21	18	36	3	15	24	39
<i>Pesticides</i>	35	1	17	19	20	16	34	2	2	34	36
<i>Other substances</i>	30	3	9	24	19	14	33	0	22	11	33
<i>Nitrites</i>	20	0	17	3	7	13	18	2	1	19	20
<i>Inedible plants</i>	15	0	3	12	6	9	15	0	6	9	15
<i>Unknown substances</i>	13	2	9	6	9	6	12	3	1	14	15
<i>Caustics</i>	10	0	6	4	2	8	10	0	5	5	10
<i>Heavy Metals</i>	10	0	5	5	2	8	10	0	6	4	10
<i>Poisonous mushrooms</i>	4	2	1	5	3	3	6	0	2	4	6
<i>Nicotine</i>	1	3	2	2	1	3	4	0	1	3	4

A=accidental, V=voluntary, R=rural, U=urban, F=female, M=Male

**Table 3.** PED intoxications by substance type

Frequency	Type		Place		Patient's Sex		Coma		Admitted		Total
	A	V	R	U	F	M	No	Yes	No	Yes	
<i>Other prescription drugs</i>	34	19	15	38	26	27	53	0	22	31	53
<i>Salicylates &amp; NSAIDs</i>	17	12	8	21	20	9	28	1	9	20	29
<i>Antibiotics</i>	15	14	14	15	21	8	27	2	6	23	29
<i>Sedatives &amp; Hypnotics</i>	8	19	9	18	23	4	24	3	6	21	27
<i>Cardio-vascular (effect)</i>	16	7	6	17	18	5	23	0	9	14	23
<i>Anticonvulsants</i>	8	14	10	12	18	4	16	6	1	21	22
<i>Vitamin supplements</i>	18	4	5	17	12	10	22	0	16	6	22
<i>Metoclopramide</i>	9	9	3	15	14	4	18	0	2	16	18
<i>Acetaminophen</i>	5	13	5	13	14	4	18	0	4	14	18
<i>Unknown drugs</i>	3	12	7	8	10	5	12	3	2	13	15
<i>Mineral supplements</i>	5	4	4	5	6	3	9	0	3	6	9
<i>Metamizole sodium</i>	1	8	2	7	8	1	9	0	1	8	9
<i>Histamine antagonists</i>	6	2	5	3	4	4	7	1	3	5	8
<i>Antidepressants</i>	3	4	1	6	7	0	6	1	3	4	7
<i>Contraceptives</i>	4	1	1	4	5	0	5	0	3	2	5
<i>Theophylline</i>	0	3	2	13	3	0	2	1	0	3	3

A=accidental, V=voluntary, R=rural, U=urban, F=female, M=Male

NSAID=non-steroidal anti-inflammatory drug

**Table 4.** PED prescription drug intoxications - detailed

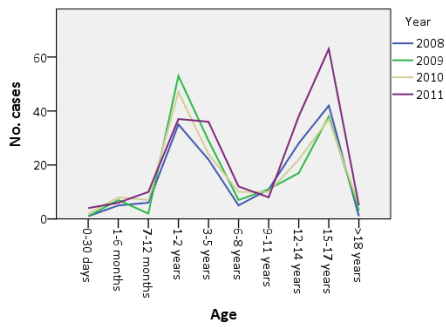


Fig. 1. PED intoxication cases by age & year

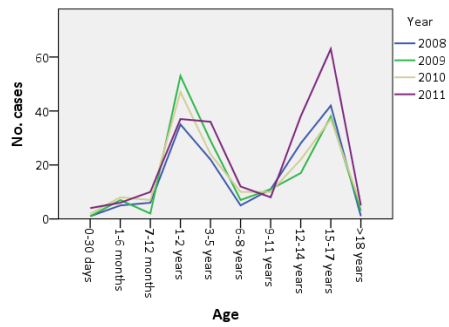


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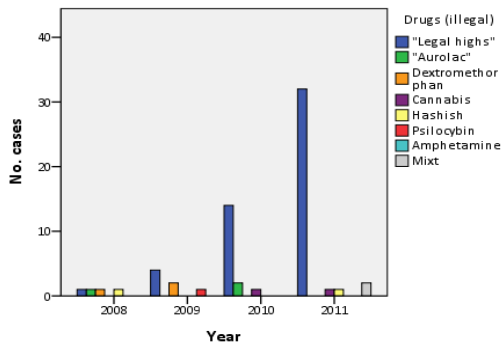


Fig. 3. PED illicit drug intoxications by year

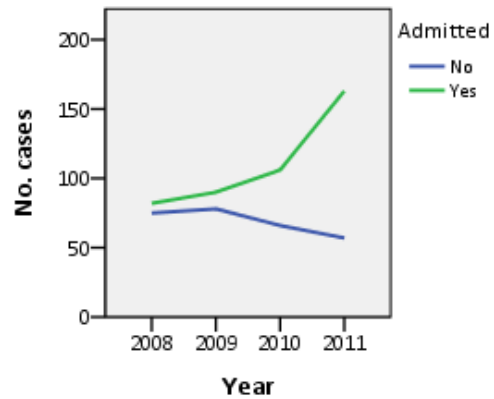


Fig. 4. PED cases admitted to toxicology ward

Analyzing the hospital’s electronic database we collected data from all patients diagnosed with acute intoxications. We recorded clinical and demographic information as well as substance type from each patient included in the study.

In terms of demographics, we analyzed differences between patients coming from urban versus rural area. We used several age categories for analysis: 0-30 days, 1-6 months, 7-12 months, 1-2, 3-5, 6-8, 9-11, 12-14, 15-17, over 18 years. Distribution among males and females was also assessed.

The type of substance was recorded for every patient and whether it was accidentally or voluntary and assessed its relation with age. Subsequently we analyzed the seasonal trend related to certain types of intoxications. The admittance rate and length of in-hospital stay was recorded.

**Statistical analysis:** All data was collected in a Microsoft Excel Database. Statistical analysis, was performed the Statistical Package for Social Science (SPSS version 19, Chicago, IL, USA). A significance level of

$\alpha=0.05$  has been chosen, with p values < 0.05 considered statistically significant.

Ethics approval was obtain from the local hospital ethic board.

**Results**

In this time frame the PED saw a total number of 76 223 visits, out of which 717 were acute intoxication cases.

The number of acute intoxications diagnosed in the PED has increased continuously during the study period, from 157 cases in 2008 to 220 cases in 2011. Although there has been an increase of 40.1% in acute intoxication cases, these absolute values strongly correlate with the total number of patient visits in the PED each year, with an average of 0.95% intoxication diagnosis per year ( $\chi^2$  test,  $p=0.008$ ).

Out of the 717 cases of acute intoxications diagnosed in the PED, 60.4% were accidental. The distribution by age (figure 1) shows a clear polar grouping around the 1-5 year olds group and the 12-17 year olds group. A similar distribution by age and type of intoxication (accidental vs.

voluntary) shows a close resemblance to the overall age distribution (figure 2), with a strong statistical correlation between them ( $\chi^2$  test,  $p=0.001$ ). Out of the total 433 cases of accidental intoxications, 64.2% were from the 1-5 year olds group. The ratio between females and males was 1.06. Both were just as likely to present with acute intoxication in the PED, the difference between sexes being the type of substance preferred. While teenage females mainly ingested prescription drugs (67%), teenage males chose ethanol (71%) and illicit drugs (66.7%).

Urban intoxications are 1.8 times more frequent than rural ones, with a total of  $n=461$  (64.3%) intoxications taking place in urban areas and  $n=256$  (35.7%) in rural areas.

Out of all the substance types registered, only Nitrites saw a larger rural-urban ratio, with 17 vs. 3 cases (table 3), explained by the nature of the substance and the main application in agricultural activities. The distribution by month highlighted some differences between the two populations, with peak activity in the months of March & September for the rural group and in the months of February – March, June & November for the urban group. The age distribution shows the same polar split as we observed on the global study population, but with different peak amplitudes according to area. The rural study population had more intoxications in the 1-5 years old group (103 vs. 88), while the urban population presented more cases from the 12-17 years old group (180 vs. 197). The rural population is slightly more prone to accidental intoxication, especially in the case of young children. Despite a slight dip in the number of cases from rural areas reported in 2008 – 2010, we observed a sharp increase of almost 53.3 % in intoxication cases from 2010 to 2011, following the upwards trend encountered in the urban areas.

An altered mental state was observed in  $n=46$  (6.4%) of patients during the first medical evaluation, resulting in a mild to medium coma mostly due to voluntary intoxication with alcohol, prescription drugs and illicit drugs (60.52%). We observed two distinct peaks of activity.

The cold months, especially December and January, are also the ones that see the most Carbon Monoxide (CO) intoxications due to the fact that wood burning is still a popular method of heating the house among the low income population and some of the stoves are improvised installations. Out of the total  $n=39$  cases of CO intoxication, only 3 (7.7%) resulted in coma and 24 (61.5%) were admitted to hospital for observation and treatment (table 3).

A total of  $n=441$  (61.5%) patients presenting with intoxications to the PED were admitted to the PTW. The ratio has been growing steadily from 52.2% in 2008 to 70% in 2011 (table 1), with a sharper increase between 2010 – 2011 of 53.8% (figure 4). The mean hospital stay was 3.2 days, with 81.45% of admitted patients staying less than 5 days.

Prescription drugs were the most common cause of intoxication observed in the PED, with  $n=247$  (34.4%) cases reported in the 4 year period of the study (table 3). Due to the diverse nature of substances covered by this generic class, it was further divided into drug types (table

4). After the reclassification, it was apparent that none of the prescription drug subclasses could rival the top most common toxic – alcohol, it being responsible for  $n=127$  (17.7%) intoxications (122 ethanol & 5 rubbing alcohol). Ethanol overdoses were 2.43 times more common in urban areas compared to rural areas, and 2.53 times more frequent in the male population. It was also a leading cause of coma in patients presenting to the PED with altered mental status  $n=21$  (45.65% of coma cases). Out of the 127 alcohol intoxications,  $n=117$  were voluntary overdoses, with the majority being teenage males from urban areas. The surprising find was that ethanol's popularity has been in slow decline in the PED, the difference being filled by an increase in illicit drug use.

The second most common cause of intoxication was illegal substance use, with  $n=63$  (8.8%) cases reported. This type of toxic has had an exponential increase in popularity over the years (figure 3). In particular, a subgroup known as "legal highs" or "ethno botanic", was the most popular recreational drug used  $n=50$  (mainly by inhaling or smoking), followed at a long distance by natural cannabinoids  $n=4$ . The vast majority of cases  $n=60$  (95.2%) were from the 12-17 year olds group. Illicit drug intoxications were 3.2 times more common in urban areas compared to rural ones, and 2 times more frequent in the male population. Teenage males from urban areas are more susceptible to this toxic, mostly due to increased accessibility on-line and in illegal shops. A total of  $n=5$  patients presented with coma due to illicit drug overdose (10.87% of coma cases).

In contrast, teenage females were more prone to overdose on prescription drugs (67%). The vast majority of multi drug overdoses were part of the 12-17 year olds group. Intoxications due to medication were 1.95 times more common in urban areas, and 2 times more frequent in the female population. There were  $n=12$  patients with altered mental status due to prescription drug overdose (26% of coma cases), with anticonvulsants and sedatives representing the major toxic responsible  $n=9$ . A detailed breakdown of the drug subgroups and tendencies can be found in table 4.

Detergents (from household products) were among the most common toxics to cause intoxications in younger children (1-5 years;  $n=46$ ; 82.14%), showing a steady increase of 47.5% per year on average. All poisonings caused by detergents were accidental and 2 times more frequent in urban areas.

Volatile substances, such as chlorine based washing products (34.7%) and solvents (paint thinners) (38.8%) were equally popular among young children (1-5 years;  $n=41$ ; 69.5%).

## Discussion

This clearly shows that most voluntary pediatric poisonings are in fact overdoses, occurring in groups of teenagers with clear intent, for either recreational use or (para) suicidal purposes.

The urban high rate can be explained by Romania's national demographic, with 55.2% of the population living

in urban areas (5), but also by the abundance and easier access to legal and illegal substances in larger, more populated communities.<sup>2</sup>

The first peak for alcohol is grouped the cold months of the year (November – February), which coincide with the winter holidays, New Year's celebrations and brief winter school vacations that provide ample opportunity for both young children and teenagers alike to explore their surrounding and ingest known or unknown substances readily available at winter fairs and parties. The second peak is in July, which coincides with the end of the school year and exam periods.

The "legal highs" packs probably contain synthetic cannabinoids and cathinones among other substances, but the exact composition is hard to track due to the uncertain origin of the products and intentional mislabeling.

The status of household substances has increased among young children in part due to the newer forms of presentation; liquid detergents can be easily confused as soft drinks and are particularly appealing to toddlers exploring their surroundings.

Along with detergents, nitrites, pesticides and ornamental flowers, volatile substances represent the most common substances children accidentally ingest. Similar results were reported by the WHO and other studies (6, 7).

The rise in the total number of pediatric intoxications presenting to the PED is attributed to an overall increase in patients and not a shift in the presenting pathology and is in line with the national average of 1%. (8) This result was lower than the average reported in other countries like France (3% of total medical emergencies) (9), Turkey (Eskisehir, 2.31% of overall emergency unit visits in 2009) (7).

According to The European School Project on Alcohol and other Drugs (ESPAD) Romania's youth is at or below the European average on cigarette use, alcohol use, cannabis and other illicit drug use, tranquilizer use (without prescription) and inhalant use (10). The slow downwards trend for alcohol observed in the study can also be found in the ESPAD report, remaining steady with little to no change over the years. Although alcohol's popularity is declining, it still is one of the most frequent toxics identified in pediatric intoxications due to its low price, abundance and ease of access. Our results were significantly lower than those reported in a Croatian study, in which 40.2% (vs. 17.7%) of all pediatric hospitalizations were due to alcohol overdose (11).

In contrast with alcohol, "legal highs" have been experiencing a surge in popularity among teenagers in Romania. Between 2005 and 2011 the European Monitoring Centre for Drugs and Drug Addiction has identified 164 new psychoactive substances, with 49 being reported in 2011 alone (2). The speed with which new substances are created is cause for concern, especially due to the fact that sales continue almost unhindered online, despite attempts to close down physical shops. In January 2012 there were at least 693 online shops offering to supply psychoactive substances or products likely to contain them. This number has increased constantly from 170 in 2010 to

314 in 2011 (2). The magnitude of the phenomenon is visible in our study as well. "Legal highs" had the fastest and strongest growth of all toxics identified in the study, increasing by 50% from 2008-2009, 183% from 2009-2010 and 111.8% from 2010-2011. It remains to be seen if local, national and international policies will slow or even reduce the expansions of such drugs.

The increasing number of patients presenting in the PED with acute intoxications are a clear sign that there is an increasing need for a comprehensive Pediatric Toxicology Ward to cater for a growing population coming in contact with an ever evolving array of new substances, some potentially harmful<sup>6</sup>. Health care quality can and should be constantly improved by creating new hospital-wide protocols to manage acute intoxications caused by the most frequently involved and toxic substances, as well as those caused by novel substances if new evidence based treatments emerge (12). All this should occur in conjunction with a continuous education for health-care providers in order to deliver the most efficient services possible.

Child injury prevention can also be improved by implementing better labelling regulations, improving storage and child resistant packaging (6). Alongside these wide-reaching measures, a better understanding of the relationship between caregiver and child with focus on prevention and care-giver education can reduce child mortality and morbidity due to accidental poisonings (13, 14).

Lastly, we would like to emphasize the importance of interactive, international poisoning surveillance and reporting tools, such as the upcoming Global Pediatric Emergency Poisoning Surveillance System or the Toxic registry (15).

## Conclusions

As the county's population increases, the demand for quality health care will grow. The increasing number of pediatric intoxications is a clear sign that local Pediatric Emergency Departments and Toxicology Wards must keep pace with an evolving population. Hospital administrations must adapt protocols to fit current trends and provide health-care professionals with constant training in regards to novel psychoactive substances, as well as up to date evidence based treatments.

In spite of the steady 1% proportion of pediatric intoxications in relation with total PED visits, there has been a shift in substance preference, especially among teenagers. Alcohol remains a popular "legal" drug for male teens, but it has seen a slowing trend, with the void being filled by new "legal highs". A greater effort must be undertaken to provide urban areas with education, prevention (outdoor activities and group sports) and harm-reduction programs for children and parents alike, due to the higher frequency of poisoning situations.

## Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the

article.

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