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Intoxication with psychoactive substances as a cause of paediatric hospital admissions: an observational study

Analiza zatruc substancjami psychoaktywnymi wśród dzieci i młodzieży jako przyczyna hospitalizacji – badanie obserwacyjne

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Abstract

Introduction and objective: Psychoactive substances intoxication among children and adolescents still poses a significant problem. **Objective:** The aim of the study was to assess paediatric patients intoxicated with psychoactive substances, who were admitted to a children's hospital and their history of comorbidities. **Materials and methods:** This retrospective study assessed medical records of paediatric patients hospitalised in the Provincial Specialist Children's Hospital in Olsztyn in the period from January 1, 2016 to December 31, 2018. The study included a group of 303 patients aged 0–18 years, diagnosed with intoxication with psychoactive substances. **Results:** In the analysed period, 303 paediatric patients were admitted due to intoxication with psychoactive substances, accounting for 0.45% of all hospitalised patients. The mean age of the patients was 14.83 ± 2.88 years. Among them there were 158 (52.15%) girls and 145 (47.85%) boys. **Conclusions:** Among children, poisoning occurs most often outside home (party, public place, plot, park). Medications and alcohol are the most common psychoactive substances used by adolescents. In the analysed period, poisonings in young people between 15 and 16 years of age were most often caused by alcohol consumption, while poisoning with other psychoactive substances most often occurred between 17 and 18 years of age. Patients with one comorbid disease were found more likely to use psychoactive substances compared to others, while patients with more than one comorbid disease use psychoactive substances and mixed drugs. Patients without comorbidities are more likely to consume alcohol.

Keywords: psychoactive substances, children, age groups

Streszczenie

Wprowadzenie i cel: Zatrucia substancjami psychoaktywnymi wśród dzieci i młodzieży stanowią wciąż aktualny problem. **Cel pracy:** Celem pracy była analiza zatruc substancjami psychoaktywnymi i występowania chorób współistniejących u dzieci zatrutych substancjami psychoaktywnymi hospitalizowanych w szpitalu dziecięcym. **Materiał i metody:** Badaniem objęto grupę 303 pacjentów w wieku 0–18 lat, z rozpoznaniem zatrucia substancjami psychoaktywnymi. Badanie miało charakter retrospektywny. Materiał stanowiły dane zawarte w dokumentacji medycznej pacjentów hospitalizowanych z powodu zatrucia substancjami psychoaktywnymi w Wojewódzkim Specjalistycznym Szpitalu Dziecięcym w Olsztynie w okresie od 1 stycznia 2016 do 31 grudnia 2018 roku. **Wyniki:** W okresie poddanych analizie hospitalizowanych było 303 pacjentów w wieku 0–18 lat, z rozpoznaniem zatrucia substancjami psychoaktywnymi, co stanowiło 0,45% ogółu hospitalizowanych. Średni wiek pacjentów wynosił $14,83 \pm 2,88$ roku. Wśród nich było 158 (52,15%) dziewcząt oraz 145 (47,85%) chłopców. **Wnioski:** Do zatruc dzieci dochodzi najczęściej poza domem (impreza, miejsce publiczne, działka, park). Wśród substancji psychoaktywnych używanych przez młodocianych dominują leki oraz alkohol. Autorzy odnotowali, że w analizowanym okresie zatrucia u młodzieży między 15. a 16. rokiem życia najczęściej były spowodowane spożyciem alkoholu, natomiast u młodzieży między 17. a 18. rokiem życia – użyciem pozostałych substancji psychoaktywnych. Pacjenci, u których stwierdzono jedną chorobę współistniejącą, częściej niż pozostali sięgają po substancje psychoaktywne, natomiast pacjenci, u których

występuje więcej niż jedna choroba współistniejąca, stosują substancje psychoaktywne oraz środki mieszane. Pacjenci, u których nie występują choroby współistniejące, częściej spożywają alkohol.

Słowa kluczowe: substancje psychoaktywne, dziecko, grupy wiekowe

INTRODUCTION

Drug use continues to pose a serious challenge and a substantial burden not only in Poland, but also throughout Europe. Around 96 million or 29% of 15–64-year-old adults in the European Union are estimated to have used illicit drugs at least once in their lifetime. Men are more likely than women to use illicit drugs (57.8 vs. 38.3 million). Cannabis is the most frequently used illicit drug (55.4 million men and 36.1 million women), while estimates of lifetime use of cocaine (12.4 million men and 5.7 million women), ecstasy (3,4-methylenedioxymethamphetamine, MDMA) (9.3 million men and 4.6 million women) and amphetamines (8.3 million men and 4.1 million women) are significantly lower. However, it is young people's access to many novel and dangerous substances that raises particular concerns. Members of the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) highlighted their concerns about the growing number of drug overdose deaths in Europe in the 2019 European Drugs Report, with a continuously increasing trend. In 2015, there were 8,441 overdose deaths in Europe (EU-28, Turkey and Norway), mainly from heroin and other opioids, a 6% increase compared to the 7,950 deaths recorded in these 30 countries in 2014^(1,2).

Psychoactive substances are considered all agents which, by influencing the user's brain, alter the states of consciousness, especially the reception and evaluation of external stimuli⁽³⁾.

The International Statistical Classification of Diseases and Related Health, 10th revision (ICD-10) distinguishes mental and behavioural disorders caused by the use of the following psychoactive substances: alcohol, opiates, cannabinoids, sedatives and hypnotics, cocaine, other psychostimulants (including amphetamine, caffeine), hallucinogens, tobacco, and volatile solvents⁽³⁾. New psychoactive substances, i.e. the so-called designer drugs, smarties, herbal highs or boosters, known under many names around the world, are particularly dangerous. Research has confirmed their harmful impact on the human body and the co-occurrence of various social, psychological and health problems related to the use of illicit drugs and other psychoactive substances, the use of which is associated with temporary pleasure caused by their action^(4,5).

In recent years, not only the psychoactive substances have changed, but also the ways they are administered. Currently, young people opt for the least invasive route of administration of a psychoactive substance, including sprays, incense, vapours, joints, pipes, water pipes (bongs), beverages,

intoxicating cookies or candies, or they simply swallow them. Some of these methods may be encouraging and therefore contribute to the increased use of psychoactive substances^(6,7).

The aim of the study was to assess cases of poisoning with psychoactive substances and the occurrence of comorbidities among paediatric patients admitted to a children's hospital.

MATERIALS AND METHODS

We performed a retrospective review of medical records of patients admitted to the Provincial Specialist Children's Hospital in Olsztyn in the period from January 1, 2016 to December 31, 2018 due to intoxication with psychoactive substances. The study included 303 patients aged 0–18 years, who were diagnosed with intoxication with psychoactive substances. We assessed medical records to determine which types of stimulants were used by the patients, assess the relationship between age and gender and the frequency of using certain substances, as well as determine places where such events occur, concentrations of toxic substances in body fluids (blood, urine), as well as the relationship between the use of psychoactive substances and chronic conditions.

The research was based on a quantitative method using an original research tool – a questionnaire containing groups of questions to collect medical history data.

The study was approved by the Bioethics Committee of the Medical University of Białystok (Resolution No. R-I-002/399/2018), and adhered to the principles of the Declaration of Helsinki.

Statistical analysis

Excel 2019 spreadsheet was used for data collection. Statistical analysis was performed using Microsoft Excel 2019 and TIBCO Statistica 3.3PL. Qualitative parameters were described using the number of cases (*n*) and percentage in relation to the entire group (%). The chi-square test was used to assess the relationship between two qualitative features. Statistical significance was set at $p \leq 0.05$.

RESULTS

Cases of intoxication

A total of 66,035 patients were admitted to the Provincial Specialist Children's Hospital in Olsztyn,

Type of intoxication	Age [years]												Total	
	0–4		9–10		11–12		13–14		15–16		17–18			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Alcohol	–	–	–	–	6	40.0	46	55.4	56	50.5	23	28.0	131	43.2
Psychoactive substances	9	100	3	100	9	60.0	35	42.2	45	40.5	45	54.9	146	48.2
Mixed	–	–	–	–	–	–	2	2.4	10	9.0	14	17.1	26	8.6
Total	9	100	3	100	15	100	83	100	111	100	82	100	303	100

$\chi^2 = 42.74, p < 0.00001$.

Tab. 1. Distribution of the number of patients in particular age groups by the type of intoxication

including 303 admissions due to poisoning with psychoactive substances (0.45% of all admissions), in the study period. The majority (approximately 90%) of patients were 13–18 years of age, with approximately one third (36.56%) aged 15–16 years. Patients aged 13–14 and 17–18 years accounted for 27.29%, whereas 11–12-year-olds accounted for 4.95%. Children aged 0–4 and 9–10 years accounted for 2.92% and 0.99%, respectively. There were no admissions in the 5–8-year age group. We analysed substances causing poisoning from three groups: alcohol, psychoactive substances and mixed substances (alcohol and psychoactive substances). Psychoactive substances (48.2%), followed by alcohol (43.2%) were responsible for the majority of poisoning cases, while approximately 1 in 10 patients (8.6%) were diagnosed with mixed intoxication. The distribution of the number of patients in particular age groups depending on the type of poisoning varied significantly ($\chi^2 = 42.74, p < 0.00001$) (Tab. 1).

Patients up to 12 years of age were admitted mainly due to intoxication with psychoactive substances. Those aged 13–16 years were significantly more likely to be admitted due to alcohol poisoning, while adolescents aged 17–18 years were hospitalised for mixed intoxication.

The analysis of the types of intoxication by gender showed no statistically significant differences ($\chi^2 = 3.07, p < 0.21$). The distribution of poisonings in the groups of boys and girls was similar to that in the total group (Tab. 2).

We further assessed the relationship between the type of intoxicating psychoactive substance and the place where the event occurred. This relationship was found to be statistically significant ($\chi^2 = 65.59, p < 0.000001$). Alcohol intoxication occurred significantly more often outside the home, while poisoning with psychoactive substances occurred significantly more frequently in the home setting (Tab. 3).

Cases of ethanol intoxication

The analysis of the types of alcohol consumed included beer, wine, vodka and unspecified alcohol. A total of 157 patients were admitted with symptoms of alcohol poisoning. The largest percentage of these patients (59.2%) experienced symptoms of poisoning after consuming vodka, followed by an unspecified type of alcohol (19.1%) and beer (18.5%). The fewest patients (3.2%) developed symptoms of poisoning after consuming wine.

Type of intoxication	Girls		Boys		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Alcohol	65	44.8	66	41.8	131	43.2
Psychoactive substances	64	44.1	82	51.9	146	48.2
Mixed	16	11.1	10	6.3	26	8.6
Total	158	100	145	100	303	100

$\chi^2 = 3.07, p < 0.21$.

Tab. 2. Poisoning distribution by gender

Type of poisoning	Home		Outside home		School		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Alcohol	24	20.3	87	66.4	20	37.1	131	43.2
Psychoactive substances	85	72.1	31	23.7	30	55.5	146	48.2
Mixed	9	7.6	13	9.9	4	7.4	26	8.6
Total	118	100	131	100	54	100	303	100

$\chi^2 = 65.59, p < 0.000001$.

Tab. 3. Poisoning distribution by the site of event

Alcohol consumption was reported only for patients aged 11–18 years. There were no cases of alcohol poisoning in younger children. There were no statistically significant differences in the type of alcohol consumed in individual age groups. The distribution of the number of patients in particular age groups depending on the type of alcohol consumed was similar ($\chi^2 = 10.13, p < 0.81$) (Tab. 4).

There were no statistically significant differences in the type of alcohol consumed (vodka, beer, wine, unspecified alcohol) between girls and boys. The distribution of the number of intoxicated patients in the groups of girls and boys by the type of alcohol consumed was similar ($\chi^2 = 6.12, p < 0.10$).

Analysis of blood alcohol levels in patients with symptoms of alcohol poisoning ($n = 157$) showed that approximately 1 in 4 patients (26.1%) had a blood alcohol level <1 permille. Blood alcohol level >2 – 2.5 permilles was found in 21.7% of patients with symptoms of poisoning. Blood alcohol levels of 1 – 1.5 , >1.5 – 2 , and >2.5 – 3 permilles were detected in 20.4%, 18.5%, and 10.2% of patients, respectively. About 3.1% of patients had blood alcohol concentration of >3 permilles.

Type of alcohol	Age [years]												Total	
	0–4		9–10		11–12		13–14		15–16		17–18			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Beer	–	–	–	–	–	–	8	16.7	11	16.7	10	27.2	29	18.5
Wine	–	–	–	–	–	–	1	2.1	1	1.6	3	8.2	5	3.2
Vodka	–	–	–	–	5	83.3	32	66.7	39	59.0	17	45.7	93	59.2
Unspecified	–	–	–	–	1	16.7	7	14.5	15	22.7	7	18.9	30	19.1
Total	–	–	–	–	6	100	48	100	66	100	37	100	157	100
$\chi^2 = 10.13, p < 0.81.$														

$\chi^2 = 10.13, p < 0.81$.

Tab. 4. Characteristics of patients with symptoms of alcohol poisoning by the type of alcohol consumed in particular age groups (*n* = 157)

Blood alcohol [permilles]	Age [years]												Total	
	0–4		9–10		11–12		13–14		15–16		17–18			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
<1	–	–	–	–	3	50.0	5	10.5	18	27.3	15	40.5	41	26.1
1–1.5	–	–	–	–	1	16.7	17	35.4	13	19.7	1	2.7	32	20.4
>1.5–2	–	–	–	–	–	–	11	22.9	8	12.1	10	27.1	29	18.5
>2–2.5	–	–	–	–	2	33.3	10	20.8	17	25.8	5	13.5	34	21.7
>2.5–3	–	–	–	–	–	–	5	10.4	5	7.6	6	16.2	16	10.2
>3	–	–	–	–	–	–	–	–	5	7.5	–	–	5	3.1
Total	–	–	–	–	6	100.00	48	100.00	66	100.00	37	100.00	157	100
χ² = 42.15, <i>p</i> < 0.02.														

$\chi^2 = 42.15, p < 0.02$.

Tab. 5. Characteristics of patients with symptoms of alcohol intoxication by blood alcohol levels in specific age groups (*n* = 157)

Blood alcohol [permilles]	Boys		Girls		Total	
	<i>n</i>	%	<i>n</i>	%		
<1	18	22.2	23	30.2	41	26.1
1–1.5	16	19.8	16	21.1	32	20.4
>1.5–2	15	18.5	14	18.4	29	18.5
>2–2.5	17	20.9	17	22.4	34	21.6
>2.5–3	10	12.4	6	7.9	16	10.2
>3	5	6.2	–	–	5	3.2
Total	81	100	76	100	157	100

$\chi^2 = 8.42, p < 0.13$.

Tab. 6. Distribution of blood alcohol levels in groups of girls and boys with symptoms of alcohol poisoning (*n* = 157)

The distribution of the number of patients with symptoms of alcohol poisoning in particular age groups by blood alcohol levels varied significantly ($\chi^2 = 42.15, p < 0.02$) (Tab. 5).

Patients aged 11–12 years and 17–18 years were significantly more likely to have blood alcohol levels >1 permilles. Blood alcohol concentrations in 13–14-year-olds, 13–14-year-olds and 17–18-year-olds, 11–12-year-olds, 17–18-year-olds, and 15–16-year-olds were 1–1.5, 1.5–2, 2–2.5, 2.5–3, and >3 permilles, respectively.

There were no statistically significant differences in blood alcohol concentrations between girls and boys. The distribution of the number of patients with symptoms of alcohol poisoning in the groups of girls and boys by blood alcohol concentration was similar ($\chi^2 = 8.42, p < 0.13$) (Tab. 6).

Cases of intoxication with other psychoactive substances

We further analysed the types of psychoactive substances used. A total of 172 patients with symptoms of psychoactive substance poisoning were admitted. The following psychoactive substances were analysed: ecstasy, cocaine, methamphetamine, amphetamine, tetrahydrocannabinol (THC; hashish, marijuana), designer drugs, medications, intranasal mephedrone and others. Other sources of poisoning included GBL (gamma-butyrolactone) – wheel cleaner and Indian moss.

The majority (47.1%) of patients with symptoms of psychoactive substance poisoning took medications. One in four patients (26.2%) were admitted with symptoms of poisoning with designer drugs. Symptoms of THC (hashish, cannabis) poisoning occurred in 13.4% of patients with symptoms of psychoactive substance intoxication. Other psychoactive substances were the cause of poisoning in 13.3% of patients. No cases of poisoning with substances such as ecstasy, cocaine or methamphetamine were reported in the study group.

The distribution of the number of patients with symptoms of psychoactive substance poisoning in particular age groups, depending on the type of psychoactive substances, varied significantly ($\chi^2 = 51.98, p < 0.007$) (Tab. 7).

Poisoning with amphetamine was significantly more common in the age group of 17–18 years. THC (hashish, cannabis) poisoning was significantly more common in patients aged 13–14 and 17–18 years. Intoxication with designer drugs was significantly more common in the age groups

Type of psychoactive substance	Age [years]												Total	
	0–4		9–10		11–12		13–14		15–16		17–18			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Ecstasy	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cocaine	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Methamphetamine	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Amphetamine	–	–	–	–	–	–	–	–	1	1.8	3	5.1	4	2.3
THC (hashish, marijuana)	–	–	–	–	–	–	7	18.9	3	5.5	13	22.0	23	13.4
Designer drugs	–	–	–	–	2	22.2	4	10.8	21	38.2	18	30.5	45	26.2
Medications	7	77.8	3	100	6	66.7	23	62.2	22	40.0	20	33.9	81	47.1
Intranasal mephedrone	–	–	–	–	–	–	–	–	2	3.6	1	1.7	3	1.7
Denied use	–	–	–	–	–	–	1	2.7	5	9.1	1	1.7	7	4.1
Other	2	22.2	–	–	1	11.1	2	5.4	1	1.8	3	5.1	9	5.2
Total	9	100.00	3	100.00	9	100.00	37	100.00	55	100.00	59	100.00	172	100.00
χ ² = 51.98, <i>p</i> < 0.007.														

$\chi^2 = 51.98, p < 0.007$.

Tab. 7. Characteristics of patients with symptoms of intoxication with psychoactive substances by their types in different age groups (n = 172)

15–16 and 17–18 years. Poisoning with medications occurred significantly more often in patients aged 0 to 14 years. Intoxication with intranasal mephedrone was significantly more common in patients aged 15–16 years. Other types of poisoning occurred significantly more often in children aged 0–4 and 11–12 years. Denial of psychoactive substance use was significantly more common among patients aged 15–16 years.

The distribution of the number of patients with symptoms of psychoactive substance poisoning in the groups of girls and boys depending on the type of psychoactive substances varied significantly ($\chi^2 = 35.56, p < 0.000001$) (Tab. 8). Poisoning with substances such as THC (hashish, cannabis) and designer drugs was significantly more common in boys vs. girls. Poisonings with medications and intranasal mephedrone were significantly more common in girls vs. boys. Boys were significantly more likely to deny the use of psychoactive substances compared to girls.

During hospital stay, laboratory tests were run for patients intoxicated with psychoactive substances. The presence of 1 substance was confirmed in 155 (51.1%) respondents. Two or more substances were detected in 4.3% of patients. No psychoactive substances were detected in the tested material from 44.6% of admitted patients (Tab. 9).

A total of 137 patients with symptoms of alcohol poisoning (total n = 157) were positive for urine ethyl alcohol. Patients with symptoms of psychoactive substance intoxication had the following substances detected in the biological material: THC (hashish, cannabis), benzodiazepines, psychotropic drugs, ecstasy. The results are presented in Tab. 10.

Comorbidities in patients with symptoms of psychoactive substance intoxication

In the study group, 65.1% of patients with symptoms of poisoning had no comorbidities, while 34.9% of patients had a history of comorbidities. The most common comorbidities included behavioural disorders (11.2%), depression

Type of psychoactive substance	Boys		Girls		Total	
	n	%	n	%	n	%
Ecstasy	–	–	–	–	–	–
Cocaine	–	–	–	–	–	–
Methamphetamine	–	–	–	–	–	–
Amphetamine	1	1.2	3	3.3	4	2.2
THC (hashish, marijuana)	17	21.3	6	6.5	23	13.5
Designer drugs	30	37.5	15	16.3	45	26.6
Medications	22	27.5	59	64.1	81	46.8
Snorting mephedrone	–	–	3	3.3	3	1.6
Denied use	6	7.5	1	1.1	7	4.1
Other	4	5.0	5	5.4	9	5.2
Total	80	100	92	100	172	100

$\chi^2 = 35.56, p < 0.000001$.

Tab. 8. Distribution of the types of psychoactive substances used in groups of girls and boys with symptoms of psychoactive substance intoxication (n = 172)

(7.6%), psychoactive substance dependence (6.9%), as well as depressive and anxiety disorders (3.3%). This was followed by heart disease (3.3%), attention deficit hyperactivity disorder (2.9%), thrombocytopenia (1.9%), epilepsy (1.4%), asthma (1.3%), and diabetes (0.7%).

One comorbid disease was found in 29.7% of patients, while ≥ 2 comorbidities were reported for 5.3% of patients.

The analysis revealed a significant impact of comorbidities on the type of psychoactive substance poisoning ($\chi^2 = 15.57, p < 0.003$). Patients without comorbidities were significantly more likely to consume alcohol. Patients with one comorbid disease were more likely to use psychoactive substances than others, while those with more than one comorbid disease were more likely to use psychoactive drugs or mixed drugs (Tab. 11).

Specialist care was used by 37.6% (vs. 62.4% of patients).

The respondents used the following specialist health care: psychiatric (19.5%), psychological (11.5%), inpatient

Number of detected substances	<i>n</i>	%
0	135	44.6
1	155	51.1
≥2	13	4.3
Total	303	100

Tab. 9. Distribution of substances detected in biological material in the group of patients with symptoms of psychoactive substance poisoning

Substances present in biological material indicating the use of a psychoactive drug	<i>n</i>	%
Ethanol	137	74.5
Cocaine	–	–
Methamphetamine	4	2.2
Amphetamine	5	2.6
THC (hashish, marijuana)	23	12.5
Benzodiazepines	6	3.1
Psychotropic medications	6	3.7
Ecstasy	3	1.4
Total	184	100

Tab. 10. Distribution of substances detected in biological material in the group of patients with symptoms of psychoactive substance poisoning

psychiatric (8.6%), neurological (3.6%) and cardiac (3.6%). Less than 2% of patients were under the care of the following clinics: endocrinology, addiction treatment centre, haematology, pulmonology and dermatology (Tab. 12). In the study group of patients with symptoms of psychoactive substance poisoning, 27.7%, 8.6%, and 2.6% of children were provided with specialist care in one, two, and three clinics respectively.

DISCUSSION

Poisonings among children and adolescents continuously pose a paediatric and social problem, and, along with injuries and drownings, are one of the most common causes of mortality in this age group. The progress of civilisation has contributed to the development of chemical industry and, consequently, to an increase in the number of toxic substances and their easier availability. The “drug scene” has changed very rapidly, generating difficulties in identifying the substances used, as well as problems related to proper treatment. A large body of statistical data has

shown a global annual increase in the number of poisonings among children and adolescents, both accidental and intentional. The number of intentional poisonings committed for suicidal purposes among adolescents is alarming. It is of key importance to monitor trends in the scale of psychoactive substance in terms of both demand and supply to develop and take preventive measures^(8–11).

Research is being conducted throughout the country to demonstrate the current trends in psychoactive substance use among children and adolescents. This is most precisely illustrated by studies conducted at the level of individual centres, and the scale of this problem in this particular study is reflected in the ratio of the number of admissions due to poisoning with psychoactive substances to the total number of all hospitalised patients. Our research has shown that the average rates of intoxication admissions during the three-year observation period was 0.45% of all hospital stays. These rates were lower compared to Warsaw (2.3%), Łódź (1.4%) and Białystok (7.11%)^(9,12,13).

For many years, the use of psychoactive substances, including alcohol, was perceived as a male issue. However, according to recent research by Sierosławski and Jabłońska⁽¹⁴⁾, as well as our findings, the use of psychoactive substances in Poland is beginning to affect teenage boys and girls to a similar extent. Bitunjac and Saraga presented slightly different findings⁽¹⁵⁾.

The study mostly included urban patients (77.2%). An analysis of the number of cases in individual age groups showed a significant increase in the number of intoxication cases among young people aged 15–16 years (36.0%). Poisonings at this age can be explained primarily by behaviours typical of this developmental period. Young people are often rebellious and, as a result, they tend to experiment with banned substances. Factors predisposing to this type of behaviour, which have been already mentioned by many authors, include conflict with parents, low self-esteem, academic failures, peer conflicts and peer pressure⁽¹⁶⁾.

Based on our research and literature, it can be concluded that the vast majority of poisonings are intentional⁽¹⁷⁾. Our findings indicate that intentional poisonings accounted for 286 cases, i.e. 94.3% of all admitted intoxicated patients. Poisonings were analysed with subdivision into three categories of substances: alcohol, psychoactive substances (medicines, narcotics, stimulants) and mixed substances. The use of psychoactive substances (48.2%), mainly medications (47.1%), psychoactive substances (26.2%),

Number of comorbidities	Alcohol		Psychoactive substances		Mixed substances		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
0	100	76.3	80	54.8	17	65.4	197	65.0
1	28	21.4	55	37.7	7	26.9	90	29.7
≥2	3	2.3	11	7.5	2	7.7	16	5.3
Total	131	100	146	100	26	100	303	100

$\chi^2 = 15.57, p < 0.003$.

Tab. 11. Distribution of the number of comorbidities in the group of patients with symptoms of psychoactive substance poisoning

Specialist care	n	%
Psychological	35	11.5
Endocrine	6	1.9
Psychiatric	59	19.5
Addiction treatment centre	5	1.6
Cardiac	11	3.6
Neurological	11	3.6
Dermatological	2	0.7
Pulmonological	2	0.7
Haematological	3	0.9
Inpatient psychiatric	26	8.6

Tab. 12. Specialist care use in the group of patients with symptoms of psychoactive substance intoxication (37.6% of the study group)

THC (hashish, cannabis) (13.4%), and alcohol (43.2%) was the main cause of poisoning. Intentional poisonings were more common in females, which may indicate higher mental susceptibility, a desire to attract attention, and easy access to psychoactive substances among girls. Krawiec and Pac-Kożuchowska⁽¹⁸⁾ and Pac-Kożuchowska et al.⁽¹⁹⁾, who investigated intentional poisonings, also showed that girls are more likely to be intoxicated^(20,21).

In our study sample, 131 cases of alcohol poisoning were found, which accounted for 43.2% of all intoxicated patients; 8.6% of these patients were poisoned with alcohol and another psychoactive substance (among others, combinations of medications, designer drugs and alcohol). Furthermore, we found a high proportion of girls among patients intoxicated with alcohol, which was also reported by other authors. The results confirm the growing phenomenon of alcohol consumption among children and adolescents, with decreasing inter-gender differences^(20–22).

In the present study, alcohol consumption was reported for patients in the 11–18 years age range. No cases of alcohol intoxication were found in younger patients. Unfortunately, the age at which alcohol consumption begins is decreasing, and the percentage of patients with intoxication after consuming strong liquors, i.e. vodka (59.2%), is also alarming, which is also confirmed by other authors. In contrast, Sierosławski showed in his survey that beer is the most popular alcohol among male adolescents⁽²³⁾. It can be therefore concluded that paediatric admissions due to less potent alcohol (beer) are less common than those associated with consuming strong liquors, such as vodka^(10,17,24).

Consumption of alcohol in large quantities, especially those that exceed the threshold of intoxication, is particularly dangerous, primarily for the health of young people using psychoactive substances, but also for public order. The group of children was assessed for venous blood alcohol concentrations. These concentrations were measured using the same method and in the same laboratory operating at the Provincial Specialist Children's Hospital in Olsztyn. It should be noted that alcohol blood alcohol

levels in admitted patients ranged from 0.4 to 3.98 permilles. These observations are consistent with those of other authors, who also pointed to the fact of alcohol poisoning among children and adolescents. Both Polish and world literature indicate high blood alcohol levels in children and adolescents with alcohol poisoning. Bouthoorn et al., who conducted their research among Danish children, reported that the maximum blood alcohol concentration in this group was 5 permilles⁽²⁵⁾.

Current nationwide research indicates that alcohol consumption has become an almost daily standard among Polish youth. Admissions due to alcohol poisoning still constitute a large proportion of total emergency paediatric admissions. Unfortunately, alcohol consumption has a long-standing and well-established tradition in our country. It is consumed by adults on various occasions, such as name days, birthdays, holidays, but also to relax in stressful situations. Therefore, family and environmental patterns are important for shaping behaviours of children and adolescents. Negative patterns acquired at home are repeated in later periods of life, especially in the case of learning difficulties, peer conflicts and accumulating life difficulties. Michalczyk claims that the age of a child may contribute to the use of psychoactive substances⁽²⁶⁾. Children aged 7–11 years who have learning problems, behavioural and social functioning disorders are more likely to use psychoactive substances in older age. Children aged 12–14 years are more likely to use various types of psychoactive substances when faced with family dysfunctions. However, young people aged 15–18 years, for whom the use of various psychoactive substances is a standard, are more likely to take these agents as a result of the negative influence of their peer group⁽²²⁾. The analysis of the circumstances in which poisoning with psychoactive substances occurred in the study group showed that it was slightly more likely to occur outside the home (party, public place, park, street) (43.2%) than at home (38.9%). During the three-year analysis, a downward trend was noted in the rates of intoxication that occurred at school – from 28.4% in 2016 to 9.7% in 2018. Similar observations were made by other authors investigating poisoning with psychoactive substances in children and adolescents⁽¹²⁾. Considering the circumstances in which ethyl alcohol poisoning occurred in the study group, it was noted that only 7% of cases occurred in a home setting. The vast majority of incidents took place outside home, with slightly increased use in the summer months (June–September). The percentage of patients with comorbidities (chronic diseases) who used psychoactive substances is concerning. Comorbidities such as behavioural disorders (11.2%), depression (7.6%), psychoactive substance dependence (6.9%), depressive-anxiety disorder (3.3%), heart disease (3.3%), attention deficit hyperactivity disorder (2.9%), thrombocytopenia (1.9%), and epilepsy (1.4%) were present in 34.9% of patients. The analysis found a significant relationship between comorbidities (chronic diseases) and the type of psychoactive substance that led to intoxication. Patients without comorbidities

were significantly more likely to consume alcohol, while patients with one comorbid condition were more likely to use psychoactive substances. Children and adolescents using psychoactive substances are unaware of their potential effects on their young bodies. The population of children with chronic diseases has grown in recent years. Statistics show that 27% of children under the age of 14 years and 23% of adolescents aged 15–19 years have some kind of chronic condition. Allergies, asthma, headaches or back pain the most common chronic diseases. Children intoxicated with psychoactive substances presented with chronic comorbidities, most often behavioural disorders. The study found that chronic illnesses, such as behavioural disorders and depression, contribute to higher rates of psychoactive substance use among children and adolescents⁽²⁶⁾. Preventive measures for children and adolescents from different social backgrounds should be implemented in a planned and conscious manner, primarily by educational institutions and the family. The purpose of prevention is to eliminate or reduce social risks associated with various unfavourable circumstances that disrupt socialisation. It is also important to provide children and adolescents with comprehensive education on the issue, taking into account their developmental specificities, and to recognize the risks arising from situations that pose educational challenge, as well as to identify potential risk factors such as mental illness. For these reasons, it is necessary to educate those who work with paediatric patients, i.e. healthcare workers, teachers and psychologists⁽²⁷⁾.

CONCLUSIONS

Poisoning in children and adolescents usually occurs outside the home (parties, public places, allotments, parks). Medications and alcohol are the most common psychoactive substances used by adolescents. During the analysed period, alcohol use was most common in adolescents between the ages of 15 and 16 years, while other psychoactive substances were most frequently used by adolescents between the ages of 17 and 18 years. The presence of comorbidities was found to have a significant effect on the type of intoxication with psychoactive drugs. Patients with one comorbid condition were more likely to use psychoactive substances, while patients with more than one comorbid condition used psychoactive substances and mixed agents. Patients without comorbidities were more likely to consume alcohol.

Conflict of interest

The authors report no financial or personal relationships with other individuals or organisations that could adversely affect the content of the publication and claim ownership of this publication.

Author contributions

Original concept of study: DK, JL. Collection, recording and/or compilation of data: DK, ER. Analysis and interpretation of data: DK, JL, ER, KL. Writing of manuscript: DK, JL, KL. Critical review of manuscript: ER, KL, RS. Final approval of manuscript: JL, RS.

References

1. Rotter I, Stachura P, Mroczek B, Żułtak-Bączkowska K et al.: Zachowania antyzdrowotne młodzieży w wieku gimnazjalnym. *Fam Med Primary Care Rev* 2012; 14: 209–211.
2. Europejskie Centrum Monitorowania Narkotyków i Narkomanii: Europejski raport narkotykowy 2019. Tendencje i osiągnięcia. Urząd Publikacji Unii Europejskiej, Luksemburg 2019.
3. Kierus K, Nawrocka B, Białokoz-Kalinowska I et al.: Dopalacze – nowe zagrożenie zdrowia młodzieży. *Pediatr Med Rodz* 2011; 7: 356–360.
4. Motyka M: Dynamika zjawiska narkomanii: nowe populacje zażywających narkotyki. *Probl Hig Epidemiol* 2013; 94: 435–445.
5. Trojan E: „Dopalacze” – nowe oblicze uzależnień. Profilaktyka i zwalczanie. *Nowa Szkoła* 2015; (8): 53–59.
6. Wolańczyk T, Komender J (eds.): Zaburzenia emocjonalne i behawioralne u dzieci. Wydawnictwo Lekarskie PZWL, Warszawa 2013.
7. Motyka MA: Uwarunkowania zjawiska narkomanii wśród młodzieży woj. podkarpackiego. Część I. Analiza raportów narkotykowych. *Hygeia Public Health* 2018; 53: 114–123.
8. Loeffler G, Delaney E, Hann M: International trends in spice use: prevalence, motivation for use, relationship to other substances, and perception of use and safety for synthetic cannabinoids. *Brain Res Bull* 2016; 126: 8–28.
9. Jackowska T, Grzelczyk-Wielgóra M: Ostre zatrucia jako przyczyna hospitalizacji dzieci i młodzieży w oddziale pediatrycznym – 9-letnia analiza. *Post Nauk Med* 2014; (9): 628–632.
10. Skotnicka-Klonowicz G, Rutkowska A, Janota A et al.: Ostre zatrucia przypadkowe i celowe u dzieci i młodzieży w materiale Oddziału Klinicznego Medycyny Ratunkowej dla Dzieci USK nr 4 w Łodzi. *Probl Hig Epidemiol* 2014; 95: 400–406.
11. Załęski A, Dudek N, Borowska A et al.: Atypical profile of intoxication with the mix of new psychoactive substances. *Pediatr Pol* 2019; 94: 351–356.
12. Kamińska H, Gawlik A, Gawlik T et al.: Hospitalizacje z powodu zatrucia alkoholem etylowym wśród dzieci i młodzieży – dane pochodzące z jednego szpitala klinicznego w Polsce. *Psychiatr Pol* 2018; 52: 387–398.
13. Pawłowicz U, Wasilewska A, Olański W et al.: Epidemiological study of acute poisoning in children: a 5-year retrospective study in the Paediatric University Hospital in Białystok, Poland. *Emerg Med J* 2013; 30: 712–716.
14. Sierosławski J, Jabłońska M: Używanie alkoholu i narkotyków przez młodzież szkolną. Raport z badań ankietowych zrealizowanych w województwie mazowieckim w 2015 r. 2015: 1–153.
15. Bitunjac K, Saraga M: Alcohol intoxication in pediatric age: ten-year retrospective study. *Croat Med J* 2009; 50: 151–156.
16. Kierus K, Nawrocka B, Białokoz-Kalinowska I et al.: Zatrucia przypadkowe i celowe w latach 2006–2010 jako przyczyna hospitalizacji pacjentów w Klinice Pediatrii i Zaburzeń Rozwoju Dzieci i Młodzieży Uniwersyteckiego Dziecięcego Szpitala Klinicznego w Białymstoku. *Pediatr Med Rodz* 2011; 7: 361–365.
17. Pawłowska-Kamieniak A, Mroczkowska-Juchkiewicz A, Gołyska D et al.: Analiza społeczno-kliniczna przypadków upojenia alkoholowego u dzieci. *Probl Hig Epidemiol* 2011; 92: 692–694.
18. Krawiec K, Pac-Kożuchowska E: Retrospektywna analiza hospitalizacji z powodu celowych zatrucia deksmetorfanem w Klinice Pediatrii i Gastroenterologii Uniwersytetu Medycznego w Lublinie w latach 2008–2017. *Pediatr Med Rodz* 2019; 15: 276–280.
19. Pac-Kożuchowska E, Krawiec K, Mroczkowska-Juchkiewicz A et al.: Patterns of poisoning in urban and rural children: a single-center study. *Adv Clin Exp Med* 2016; 25: 335–340.
20. Kuželová M, Harárová A, Ondriašová E et al.: Alcohol intoxication requiring hospital admission in children and adolescents: retrospective analysis at the University Children's Hospital in the Slovak Republic. *Clin Toxicol (Phila)* 2009; 47: 556–561.
21. Skotnicka-Klonowicz G, Grochocińska P, Kuziemska A: Zatrucie alkoholem jako problem medyczny w oddziale klinicznym

- medycyny ratunkowej dla dzieci. *Zdrowie Publiczne* 2011; 121: 12–15.
22. Warrick BJ, Tataru AP, Gerona R: New psychoactive substances in pediatric patients. *Pediatr Clin North Am* 2017; 64: 1223–1241.
23. Sierosławski J: Używanie alkoholu i narkotyków przez młodzież szkolną. Raport z ogólnopolskich badań ankietowych zrealizowanych w 2011 r. Europejski program badań ankietowych w szkołach ESPAD. Warszawa 2011: 19–31.
24. Loukova A, Stankova E: Factors influencing acute alcohol poisoning in adolescents in Bulgaria. *Przegl Lek* 2011; 68: 410–412.
25. Bouthoorn SH, van Hoof JJ, van der Lely N: Adolescent alcohol intoxication in Dutch hospital centers of pediatrics: characteristics and gender differences. *Eur J Pediatr* 2011; 170: 1023–1030.
26. Michalczyk Z: Etiologia używania i uzależnienia dzieci i młodzieży od substancji psychoaktywnych. III Mazowiecki Przegląd Zdrowia Publicznego. Konferencja pt.: „Problem uzależnienia od substancji psychoaktywnych wśród dzieci i młodzieży” – II edycja. Warszawa 2020.
27. Graddy R, Buresh ME, Rastegar DA: New and emerging illicit psychoactive substances. *Med Clin North Am* 2018; 102: 697–714.