

## INTOXICATION DEATH: A TEN YEARS SURVEY

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**Abstract.** The aim of the study was to determine the frequency of death intoxication by alcohol and other types of toxic agents as drugs, industrial, carbon monoxide, mushrooms and unidentified ones. 1606 deaths in the eastern part of the country were recorded during 1992-2001. The alcohol was the most frequently toxic agent, which has caused death. There were registered 1347 (83.9%) alcohol intoxication deaths from which 28% were in women and 72% in men. Higher frequencies of death have been found in urban areas (59.8) than in rural ones (40.2). Blood alcohol levels (g‰) in alcohol intoxications were: 0.5-0.99; 1-1.99; 2-2.99; 3-3.99; 4 and over. The higher frequency of intoxication deaths was found at the level of alcoholemia of 1-3 g‰ (42%), in the groups of age 50-59 years and 40-49 years, both in men and in women. 62 deaths, from which 66% males were caused by a mixture of different toxic agents. There were registered 198 (12.3%) intoxication deaths by the other types of studied agents: drugs, carbon monoxide, industrial agents, mushrooms and unidentified ones. Intoxication deaths caused by these types of toxic agents were more frequently in rural area (53%) and in men (52.5%). The industrial agents were responsible for about 27% of intoxication death, the pesticides being the most frequently (59.8%).

**Key words:** death, intoxications, alcohol, other toxic agents, environment

**Rezumat:** Scopul studiului a fost să determine frecvența intoxicațiilor letale cu alcool și alte tipuri de agenți toxici, cum ar fi: medicamente, toxice industriale, oxid de carbon, ciuperci și toxice neidentificate. În perioada 1992-2001 au fost înregistrate 1606 decese în estul țării. Alcoolul a fost cel mai frecvent agent toxic care a condus la deces. Au fost înregistrate 1347 (83,9%) intoxicații letale cu alcool, dintre care 28% au fost la femei și 72% la bărbați. Cele mai frecvente decese au fost găsite în mediul urban (59,8) și la bărbați (52,5). Nivelele de alcoolemie găsite (g‰) au fost: 0,5-0,99; 1-1,99; 2-2,99; 3-3,99; 4 și peste. Cea mai mare frecvență a intoxicațiilor letale a fost înregistrată la o alcoolemie de 1-3 g‰ (34,5%) și la grupele de vârstă 50-59 ani și 40-49 ani, atât la bărbați cât și la femei. Cele 62 decese (3,8%) datorate unui amestec de agenți toxici au avut frecvențe egale în mediul urban și rural (50%) predominând bărbații (66,1%). Au fost înregistrate 198 (12,3%) intoxicații letale prin alte tipuri de agenți studiați: medicamente, oxid de carbon, toxice industriale, ciuperci și toxice neidentificate. Intoxicațiile letale cu aceste categorii de agenți toxici au fost mai frecvente în mediul rural (53%) și la bărbați (52,5%). Toxicele industriale au determinat 27% din decese la grupele de vârstă 30-39 ani și 50-59 ani, pesticidele fiind cel mai frecvent incriminate (59,8%).

**Cuvinte cheie:** moarte, intoxicații, alcool, alte toxice, sex, mediu de reședință, grupe de vârstă

### INTRODUCTION

Intoxications represent an important cause of death (1). In the causal specific mortality, the toxic agent intoxications are classified after tumors.

They are classified in the 10<sup>th</sup> International Classification of Diseases, as T<sub>51</sub>-T<sub>65</sub> (2).

The effects of alcohol intoxications, the most frequent one, are greatly

influenced by individual variations among users (3). Usually they are voluntary. Only in children they can appear accidentally (2). In the first phase of intoxication, with an alcoholemia of 0.50-1.50 g‰, the following symptoms are present: excitation, depression of superior nerve centers and uncontrolled activity of the inferior nerve centers, euphoria, logorea, effusiveness, emotivity and false impression of a increase cerebral activity (2,4). At an alcoholemia of 1.50-2.50 g‰, manifestations are disartria, ataxia, face's congestion, tahipnea, perspiration, hiccup, disorientation and confusion. Deeply intoxications (alcoholemia of over 3 g‰) are characterized by anesthesia, narcosis, with hipotermia, coma and abolishment of reflexes and finally, circulatory collaps and death. During sleep and coma the level of alcoholemia is diminishing. This is why the values of alcoholemia, which are determined post-mortem, do not reflect the real value during life (4,5).

Alcohol intoxication has an important role in producing deaths mainly by violence and different diseases, single or in association with other toxic agents: drugs, carbon monoxide, different industrial toxic agents and mushrooms.

In US, intoxication with carbon monoxide is the commonest accidental intoxication (the highest fire fatality rates in the developed world - 2.3 deaths per 100,000 populations) (6).

V. Beliș established that in Romania, in the past few years, deaths by intoxications are ranged in the first or second place among violent deaths (7).

Among toxic agents, pesticides are 40% deadly, carbon monoxide 20-25%, alcohol intoxication 15%, drugs intoxication 12%, industrial agents 8% and household intoxication 3%.

Industrial toxic agents like pesticides, solvents can cause death by using them voluntarily or accidentally (8).

Deaths produced by intoxication with drugs are, usually voluntary, in some cases in association with other toxic agents (9).

The pesticide (insecticide, herbicide, fungicide, rodenticide) as death cause prevailed among industrial toxic agents both in urban and rural areas (10). There are a disproportionate number of injuries and deaths related to pesticide use in developed countries as compared with its use in the developing world. As the literature points out, industrialized countries use 80 per cent of the world agrochemicals but probably suffer only 1 per cent or less of all deaths due to pesticide.

The aim of the study was to evaluate the frequency of death intoxication by alcohol and other types of toxic agents as drugs, industrial, carbon monoxide, mushrooms and unidentified ones.

#### MATERIAL AND METHODS

During 1992-2001 the acute intoxication death cases have been pursued. 1606 cases out of 4170 suspected deaths have been certified as intoxication deaths, by the Forensic Institute of Iasi.

The analysis based on the first cause of death supported by the autopsy findings, histological and toxicological

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tests and was done by sex, age and residence area of deceased. The alcohol death cases were analyzed by alcoholemia level, too.

### RESULTS AND DISCUSSION

1606 subjects died by different intoxications during the period 1992-2001. A huge number of intoxication agents were mentioned as the death cause.

1347 cases (83.9%) were intoxicated with alcohol; 198 cases (12.3%) with other toxic agents and 62 cases (3.8%) with a mixture of different toxic agents (tables 1 a-c).

As table 1a shows in urban area the alcohol death intoxications prevailed: 59.9% vs. 40.1% in rural.

Sex distribution of cases shows a higher percentage of males (72.8 vs. 27.8). Also, alcohol intoxication death

for males, were over two fold more frequent both in urban and rural areas.

Three peaks of frequency of death were recorded between 1995 and 1997 (16% for alcohol; 19-23% for other toxic agents and 16-19% for a mixture of agents). In the last group a fourth peak appeared in 2001.

The frequencies of death caused by other toxic agents are presented in table 1b. Although small differences between sexes can be seen (52.6 vs. 47.4), toxic agents caused more intoxication death in rural areas for men (28.3 vs. 24.3).

In intoxication death with a mixture of different toxic agents, 66.3% of deceased were males. The distribution by residence area indicates more female death in rural than in urban (19.2 vs. 14.5) as table 1c indicates.

**Table 1 a. The frequencies of alcohol intoxication death by sex and residence area**

Year	Urban			Rural			Urban+Rural		
	M	F	Total	M	F	Total	M	F	Total
1992	3.1	2.0	5.1	2.0	0.8	2.8	5.1	2.8	7.9
1993	3.6	1.3	4.9	2.1	0.7	2.8	5.7	2.0	7.7
1994	4.6	1.8	6.4	2.5	0.9	3.4	7.1	2.7	9.8
1995	6.2	2.6	8.8	5.1	2.3	7.4	11.3	4.9	16.2
1996	7.6	2.3	9.9	5.0	1.6	6.6	12.6	3.9	16.5
1997	6.4	3.1	9.5	4.4	1.8	6.2	10.8	4.9	15.7
1998	2.9	1.0	3.9	2.2	1.3	3.4	5.0	2.3	7.3
1999	3.2	1.1	4.3	2.1	0.4	2.7	5.4	1.5	6.9
2000	3.0	0.7	3.7	1.6	0.7	2.2	4.6	1.4	6.0
2001	2.7	0.7	3.4	1.9	0.7	2.7	4.6	1.4	6.0
Total	43.3	16.6	59.9	28.9	11.2	40.1	72.2	27.8	100

M = male; F= female

**Table 1 b. The frequencies of death caused by other toxic agents by sex and residence area**

Year	Urban			Rural			Urban+Rural		
	M	F	Total	M	F	Total	M	F	Total
1992	1.5	2.0	3.5	2.0	0	2.0	3.5	2.0	5.5
1993	1.5	3.6	5.1	1.0	1.0	2.0	2.5	4.6	7.1
1994	3.5	2.5	6.0	2.5	2.5	5.0	6.0	5.0	11.0
1995	5.1	6.1	11.2	7.1	5.1	12.2	12.2	11.2	23.4
1996	5.6	3.0	8.6	7.1	4.6	11.6	12.7	7.5	20.2
1997	5.1	3.5	8.6	6.1	4.0	10.1	11.2	7.6	18.8
1998	0	0	0	1.0	1.5	2.5	1.0	1.5	2.5
1999	0.5	1.0	1.5	0.5	1.0	1.5	1.0	2.0	3.0
2000	0.5	1.0	1.5	1.0	1.0	2.0	1.5	2.0	3.5
2001	1.0	0	1.0	0	4.0	4.0	1.0	4.0	5.0
Total	24.3	22.7	47.0	28.3	24.6	53.0	52.6	47.4	100

**Table 1 c. Intoxication death frequencies by mixture of different toxic agents, by sex and residence area**

Year	Urban			Rural			Urban+Rural		
	M	F	Total	M	F	Total	M	F	Total
1992	1.6	1.6	3.2	1.6	4.9	6.4	3.2	6.5	9.7
1993	4.9	0	4.9	4.9	0	4.8	9.8	0	0
1994	1.6	0	1.6	1.6	0	1.6	3.2	0	0
1995	8.1	4.9	13.0	1.6	3.2	4.8	9.7	8.1	17.8
1996	8.1	3.2	11.3	3.2	4.9	8.1	11.3	8.1	19.4
1997	4.9	1.6	6.5	6.5	3.2	9.7	11.4	4.8	16.2
1998	0	0	0	0	1.6	1.6	0	1.6	1.6
1999	1.6	1.6	3.2	3.2	0	3.2	4.8	1.6	1.6
2000	1.6	0	1.6	0	0	0	1.6	0	1.6
2001	3.2	1.6	4.8	8.1	1.6	9.7	11.3	3.2	14.5
Total	35.6	14.5	50.1	30.7	19.2	49.9	66.3	33.7	100

Two age groups were particularly affected by alcohol death both for males and females: 40-49 y and 50-59 y where 55% of cases were registered as table 2 data indicates.

Table 3 shows that the most deaths happened at the level of alcoholemia

of 0.5-0.99 g‰ in men than in women (25.2 vs. 9.4). The death number decrease steadily as alcohol doses rise.

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**Table 2. Alcohol intoxication deaths by sex and age**

Year	Groups of age															
	0 – 9 y				10 – 19 y				20 – 29 y				30 – 39 y			
	M		F		M		F		M		F		M		F	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
1992	0	0	0	0	0	0	0	0	2	0.1	0	0	17	1.3	2	0.1
1993	1	0.1	0	0	0	0	0	0	2	0.1	1	0.1	10	0.7	5	0.4
1994	0	0	0	0	1	0.1	0	0	4	0.3	3	0.2	17	1.3	7	0.5
1995	0	0	0	0	2	0.1	3	0.2	13	1.0	5	0.4	20	1.5	9	0.6
1996	1	0.1	0	0	4	0.3	1	0.1	12	0.9	1	0.1	34	2.5	1	0.1
1997	0	0	0	0	4	0.3	1	0.1	19	1.4	0	0	28	2.0	7	0.5
1998	1	0.1	0	0	0	0	1	0.1	2	0.1	0	0	5	0.4	4	0.3
1999	0	0	0	0	0	0	0	0	3	0.2	0	0	9	0.6	2	0.1
2000	0	0	0	0	0	0	0	0	3	0.3	0	0	7	0.5	2	0.1
2001	1	0.1	0	0	3	0.2	0	0	4	0	1	0.1	4	0.3	2	0.1
Total	4	0.4	0	0	14	1.0	6	0.5	64	4.4	11	0.9	151	11.1	41	2.8

Year	Groups of age															
	40 – 49 y				50 – 59 y				60 – 69 y				70 y and over			
	M		F		M		F		M		F		M		F	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
1992	24	1.8	7	0.5	18	1.3	12	0.9	9	0.6	4	0.3	2	0.1	10	0.7
1993	24	1.8	7	0.5	20	1.5	8	0.6	12	0.9	5	0.4	5	0.4	1	0.1
1994	26	1.9	16	1.2	17	1.3	3	0.2	18	1.3	12	0.9	5	0.4	4	0.3
1995	40	3.0	20	1.5	37	2.8	18	1.3	27	2.0	13	1.0	10	0.7	9	0.6
1996	54	4.0	15	1.1	39	2.9	15	1.1	21	1.6	12	0.9	5	0.4	4	0.3
1997	41	3.0	14	1.0	37	2.8	14	1.0	24	1.8	16	1.2	8	0.6	3	0.2
1998	24	1.8	9	0.6	20	1.5	4	0.3	12	0.9	7	0.5	2	0.1	4	0.3
1999	24	1.8	7	0.5	17	1.3	6	0.4	17	1.3	6	0.4	5	0.4	1	0.1
2000	18	1.3	6	0.4	24	1.8	2	0.1	5	0.4	2	0.1	5	0.4	6	0.4
2001	12	0.9	4	0.3	21	1.6	3	0.2	12	0.9	5	0.4	7	0.5	4	0.3
Total	287	21.3	105	7.6	250	18.8	85	6.1	157	11.7	82	6.1	54	4.0	46	3.3

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**Table 3. Alcohol intoxications deaths by sex and alcohol specific dose**

Year	Alcohol dose (g‰)																			
	0.50-0.99				1.00-1.99				2.00-2.99				3.00-3.99				4 and over			
	M		F		M		F		M		F		M		F		M		F	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
1992	22	1.6	12	0.9	12	0.9	7	0.5	16	1.2	8	0.6	10	0.7	7	0.5	10	0.7	2	0.2
1993	30	2.2	8	0.6	16	1.2	5	0.4	13	1.0	6	0.5	7	0.5	9	0.6	6	0.5	6	0.5
1994	24	1.8	16	1.2	20	1.5	6	0.5	27	2.0	10	0.7	12	0.9	7	0.5	10	0.7	7	0.5
1995	40	3.0	26	1.9	36	2.7	8	0.6	30	2.2	15	1.1	37	<b>2.8</b>	18	<b>1.3</b>	18	<b>1.3</b>	7	0.5
1996	65	<b>4.8</b>	15	1.1	38	<b>2.8</b>	13	1.0	34	<b>2.5</b>	22	<b>1.6</b>	19	1.4	8	0.6	11	0.8	9	<b>0.6</b>
1997	50	3.7	21	<b>1.6</b>	36	2.7	17	<b>1.3</b>	26	1.9	20	1.5	3	0.2	10	0.7	12	0.9	3	0.2
1998	30	2.2	6	0.5	18	1.3	8	0.6	9	0.7	4	0.3	6	0.5	5	0.4	3	0.2	5	0.4
1999	27	2.0	8	0.6	16	1.2	2	0.2	14	1.4	1	0.1	10	0.7	3	0.2	5	0.4	5	0.4
2000	23	1.7	7	0.5	18	1.3	4	0.3	11	0.8	2	0.2	6	0.5	2	0.2	3	0.2	4	0.3
2001	28	2.1	7	0.5	10	0.7	3	0.2	4	0.3	0	0	6	0.5	5	0.4	3	0.2	0	0
Total	339	25.2	126	9.4	220	16.3	73	5.5	182	13.5	88	6.5	116	8.5	74	5.5	81	6.0	48	3.6

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In the forensic-medical literature, as was mentioned above, the blood concentration of alcohol lowered after death. In this respect, the serum alcohol level after death does not reflect the real value of alcoholemia during life.

As table 3 shows, the frequency of death is inversely associated with the serum level of alcohol: 16.3% in male and 5.5% in female with an alcohol specific dose of 1-1.99 ‰; 13.5% in male and 6.5% in female with an alcohol specific dose of 2-2.99 g‰; 8.5% in male and 5.5% in female with an alcohol specific dose of 3-3.99 g‰ and 6.7% in male and 3.6% in female with an alcohol specific dose of 4 g‰. The other toxic agents as drugs, industrial toxic substances, carbon monoxide, mushrooms and unidentified

toxic substances, have been also found as death cause (table 4).

Among other types of toxic agents, the industrial agents had the higher frequencies (40.5%).

Deaths caused by intoxication with carbon monoxide, mushrooms and unidentified toxic agents had lower frequencies both in urban and rural areas.

Table 5 indicates that the most cases of drugs intoxications appeared in 20-29 y women group, whereas the highest number of carbon monoxide intoxications death was recorded in woman over 70 y age.

Industrials agents were frequently incriminated as death cause for men over 30 y and females 50-59 years. Most mushroom intoxications were recorded in children under 10 y.

**Table 4. The frequencies of intoxication death by different agents by sex and residence area**

Type of toxic agent	Residence area						
	Urban		Rural		Urban+Rural		
	M	F	M	F	M	F	Total
Drugs	3.0	6.6	1.5	4.6	4.5	11.2	15.7
Carbon monoxide	9.1	4.0	4.6	3.0	13.7	7.0	20.7
Industrial	10.1	7.7	10.6	12.1	20.7	19.8	40.5
Mushrooms	2.0	4.0	3.5	6.6	5.5	10.6	16.1
Unidentified	1.5	3.0	1.0	1.5	2.5	4.5	7.0
Total	25.7	25.3	21.2	27.8	46.9	53.1	100

**Table 5. Intoxication deaths by other toxic agents and by groups of age**

Group of age (y)	Type of agent																			
	Drugs				Carbon monoxide				Industrial agents				Mushrooms				Unidentified			
	M		F		M		F		M		F		M		F		M	F		
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
0-9	1	0.5	0	0	4	2.0	0	0	1	0.5	2	1.0	8	4.0	10	5.1	0	0	2	1.0
10-19	0	0	1	0.5	4	2.0	4	2.0	0	0	2	1.0	2	1.0	3	1.5	1	0.5	3	1.5
20-29	3	1.5	5	<b>2.6</b>	3	1.5	3	1.5	0	0	7	3.5	0	0	5	2.5	0	0	1	0.5
30-39	1	0.5	4	2.0	3	1.5	1	0.5	14	7.1	5	2.6	0	0	0	0	0	0	0	0
40-49	0	0	4	2.0	4	2.0	0	0	9	4.6	7	3.5	0	0	0	0	2	1.0	3	1.5
50-59	4	<b>2.0</b>	2	1.0	4	2.0	0	0	11	5.6	11	<b>5.6</b>	1	0.5	2	1.0	1	0.5	0	0
60-69	0	0	2	1.0	2	1.0	0	0	3	1.5	2	1.0	0	0	1	0.5	0	0	0	0
70 and over	0	0	4	2.0	3	1.5	6	<b>3.0</b>	3	1.5	3	1.5	0	0	0	0	1	0.5	0	0
Total	9	4.5	22	11.1	27	13.5	14	7.0	41	20.8	39	19.7	11	5.5	21	10.6	5	2.5	9	4.5

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The annual frequencies of intoxication death due to different industrial agents are detailed in table 6.

The highest frequencies of deaths (17.0 in 1996, 12.5 in 1997 and 10.7 in 1995) were due to pesticides.

The results of this study highlight the necessity of health programmes in

order to prevent or/and diminish the actual rates of alcohol consumption, as well as the understanding and observance of protective measures against other toxic agents (such as drugs, carbon monoxide, mushrooms, industrial agents).

**Table 6. Intoxication death frequencies by industrial agents**

Year	Pesticide	Etilenglicol	Caustic soda	Furadon	Others	Total
1992	3.6	1.8	1.8	0	3.6	10.8
1993	6.5	0	0.9	0	0.9	8.3
1994	5.4	1.8	1.8	0.9	0	9.9
1995	10.7	2.7	2.7	1.8	0.9	18.8
1996	17.0	0.9	1.8	3.6	0.9	24.2
1997	12.5	0.9	0	0	2.7	16.1
1998	0	0	0	0.9	0	0.9
1999	3.6	0	0	0.9	0.9	5.4
2000	0	0	0	1.8	0.9	2.7
2001	0.9	0.9	0	1.8	0	3.6
Total	59.8	8.9	8.9	11.6	10.7	100

### CONCLUSIONS

- During 1992-2001, 1606 cases out of 4170 suspected deaths recorded at the Forensic Institute of Iasi have been certified as intoxication deaths.
- 83.9% of these intoxications were with alcohol, 12.3% with other toxic agents and 3.8% with a mixture of different toxic agents.
- Alcohol intoxications deaths were more frequently in urban area (59.9%) and in men (72.2%). Deaths by intoxications with other toxic agents were more frequently in rural area (53.0%) and in men (52.6%). The frequency of intoxication deaths by a mixture of different toxic agents was equally both in urban and in rural area (50.0%).
- The majority of alcohol intoxication deaths were registered both in men and in women in the groups of age 50-59 years and 40-49 years.
- About 42% of alcohol death were associated with alcoholemia levels of 1-3 g‰; 34.6% with 0.50-0.99 g‰; and 23.6 g‰ with over 3 g‰.

- The industrial agents were responsible for about 40.5% of intoxication deaths, the pesticides being the most frequently (59.9%).

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