

## ORIGINAL ARTICLE

# The impact of acute intoxications in a toxicological unit care in North East Italy

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## Key words

Acute intoxication • Emergency department • Epidemiology • Italy

## Summary

Retrospective study in a Toxicological Unit Care (TUC) performed to know the epidemiology of acute intoxication (AI) in Verona (Italy) during years 2008-2009.

All data regarding patients with a diagnosis of certain/suspected AI were collected and evaluated: some demographic information, the characteristics of the agent involved, the pattern of exposure, the triage at the admission to TUC and the outcome.

244 cases were analyzed: 45.9% males and 54.9% females, mean age respectively 45.1 and 43.9 years. The monthly distribution of admitted patients resulted fairly constant, except from a light rising prevalence in autumn, with a majority of yellow (45.9%) and green (43.4%) triage code. The pattern of exposure resulted: ingestion (82.7% of cases; age peaks: 18-34 and 35-51 years old; mostly due

to food (as mushrooms), drinks, detergents, soap, pharmaceutical, drugs of abuse, caustics substances), contact (10.2% of cases; age peak 18-51) and inhalation (6.9% of cases). In 17.2% of cases the poisoning exposure was intentional. In 63.5% the patients were sent to their general practitioners (45.5% of the yellow and 81.1% of the green coded patients) and in 22.1% of cases they were admitted to clinical rooms (44.6% of the yellow coded patients).

In most cases the triage code assigned to the studied patients resulted yellow and green. Considering that the seriousness of the symptoms can appear after several hours from the exposure to toxic substances, a quick and specific intervention to obtain the best therapeutical effectiveness is suitable, in order to save lives or to avoid irremediable health damages.

## Introduction

Toxic exposure and poisoning are big worldwide problem, especially for the huge number of new chemical, professional, pharmacological and domestic products introduced in the market. According to the available WHO data on unintentional poisoning approximately 350,000 people died Worldwide in 2000 and unintentional poisoning was the 9<sup>th</sup> most common cause of death globally in young adults (15-29 years) [1, 2]. More than 94% of fatal poisonings occurred in low- and middle-income countries [2]. The more consistent and uniform surveillance system on Acute Intoxications (AI) is represented in U.S. by the American Association of Poison Control Centers (AAPCC) until 2004 by the Toxic Exposure Surveillance System (TESS) and then replaced by the National Poison Data System (NPDS) in which 60 out of the 61 U.S. poison centers upload case data automatically. Between years 1983-2008 AAPCC recorded 48,456,030 cumulative cases with, respectively in the two range year, 251,012 and 2,4491,049 number of cases and respectively of 5,8 and 8,2 exposures per thousand population. During year 2008 1,315 human fatalities were registered [3, 4] and in 2006 poisoning in U.S. was the fifth leading cause of all the death and the second cause when considering only unintentional injury [5].

In Europe, a recent and structured picture of the phenomenon comes from Spain with "VEIA Study", conducted between years 1979-2000. During year 2004 were reported 1508 cases of acute poisoning (234/10<sup>5</sup> population), with an increase of 34% compared to 2000 (170/10<sup>5</sup> inhabitants) [6].

The data available in Italy are still fragmentary, not very recent and are limited to the most serious AI, like the ones followed by hospitalization or death. The latest data available on mortality are referred to 1998 and recorded 792 deaths for AI (0.14% of the total death) while data referred to hospitalizations during 1999 as main diagnosis of AI were 29,862 (0.31% of total admission for all the causes; rate 67,7/10<sup>5</sup> inhabitants), with a rise of 30% when considering even AI as secondary cause of diagnosis [7].

More complete and recent national data derive from a study performed between 2002 and 2003 concerning AI data flow collected from 15 Italian Emergency Department from which an estimate of a total of 240,000 of annual access was evicted [8]. So the number of supposed or really acute intoxications arriving in the hospital (66,770) appears much greater than the number of registered consultations to the Poison Centers on all the national territory showing that the involvement of emergency care for AI, even when not followed by hospitalization and therefore not traceable to any archival source, is higher compared to what appeared in previous studies [7-9].

As in Italy the phenomenon, despite being significant, appears underestimated and not up-to-date a study was conducted to investigate the prevalence of poisoning, toxic exposure pattern, severity and clinical outcome in patients admitted to an Italian (Verona) Toxicological Unit Care as a preliminarily contribute to improve the knowledge of the local epidemiological data.

## Materials and methods

Poisoning occurs when people drink, eat, breathe, inject, or touch enough of a hazardous substance which causes illness or death.

This was a retrospective hospital based study, performed between 1<sup>st</sup> January 2008 to 31<sup>st</sup> December 2009 in a Poison Control Centre named Toxicological Unit Care (TUC) in an Emergency Department (ED) in Verona, Northern Italy with an admission of approximately 98.800 patients per year.

In TUC there are four monitored beds, admitting all critical and semi-critical patients requiring invasive and non invasive treatments such as gastric lavage, cardiovascular and respiratory support and so on. Two toxicologists (medical doctor) are present 24/24 hours and 7/7 days, strictly operating with ED. The ED perform a first check and triage, sending all the intoxicated patients to the TUC.

All individual data of subjects who acceded to the department during the 24 months with a diagnosis of acute intoxication and poisoning or suspected of that were collected from the database of the TUC. Some key words such as “poisoning”, “acute intoxication”, “bleach”, “ammonia”, “mushrooms”, “ingestion”, were focused, to extrapolate patients. All alcohol abuse and carbon monoxide related AI cases were excluded since a dedicated study for both is necessary because of their peculiar occurrence in the studied geographical area. The protocol of this study was carried out according to the Helsinki Declaration and approved by the local ethical committee. The data were collected and processed in compliance with the national law on privacy (Law N. 196/2003 - Code concerning the protection of personal data).

Demographic information, the agent involved in the intoxication, the pattern of exposure, the symptomatology and its onset, the gravity of event (triage) and the outcome were collected for each subject.

The triage of patients admitted to Emergency room was divided into “red” (emergency condition, means that the subject is in danger for life and with severe compromising of vital functions), “yellow” (urgency condition, partial compromising of respiratory or cardiac functions, but without an immediate danger for life), “green” (less severe urgency condition, means lesions not involving vital functions but needing to be healed), “white” (no urgency, means deferability to General Practitioner [GP]). The patterns of exposure were coded according the following definitions: “contact”, including contact of the products with eyes, “inhalation” including breathing and aspiration of toxic substances, and “ingestion” including suspected or confirmed ingestion of toxic substances or food contaminated with microorganisms or chemical.

The agents involved in the exposures were classified as “pharmaceutical” (including chemical for therapeutic purposes), “caustic substances” (including agents which cause caustic lesion to esophagus, such as bleach or ammonia), “food and drinks” (with or without painful symptoms which include very frequently mushroom consumption), “drugs” (intended as pharmaceuticals, substances of abuse and stimulants), “other” (including substances such as soap, shampoo, detergents or other unclassifiable substances) and “lacking of information” was reported in case of absence of information about the agent occurred (the patients could not refer to) or in case of unreported symptoms.

The patterns of symptomatology during staying at TUC were coded according to following definition: “asymptomatic” means absence of any symptoms and signs; “light symptomatology” as cardiologic (palpitation, tachycardia), neurologic (light consciousness reduction) respiratory (hoarse, mild dyspnoea) or others symptoms (little painful abdominal ache, or headache or light pharyngitis etc; “severe symptomatology” includes symptoms and signs that need of treatment and control as cardiologic problems, dyspnoea, coma, severe abdominal pain etc; “unk” (unknown) includes cases lacking of information.

The outcome was divided into admission to a hospital departments, “sent to general doctor” which means going to family doctor for further treatment, “dismissal” which is returning back home and “refuse to treatment” which means decision of the patient not to be healed.

## STATISTICAL ANALYSIS

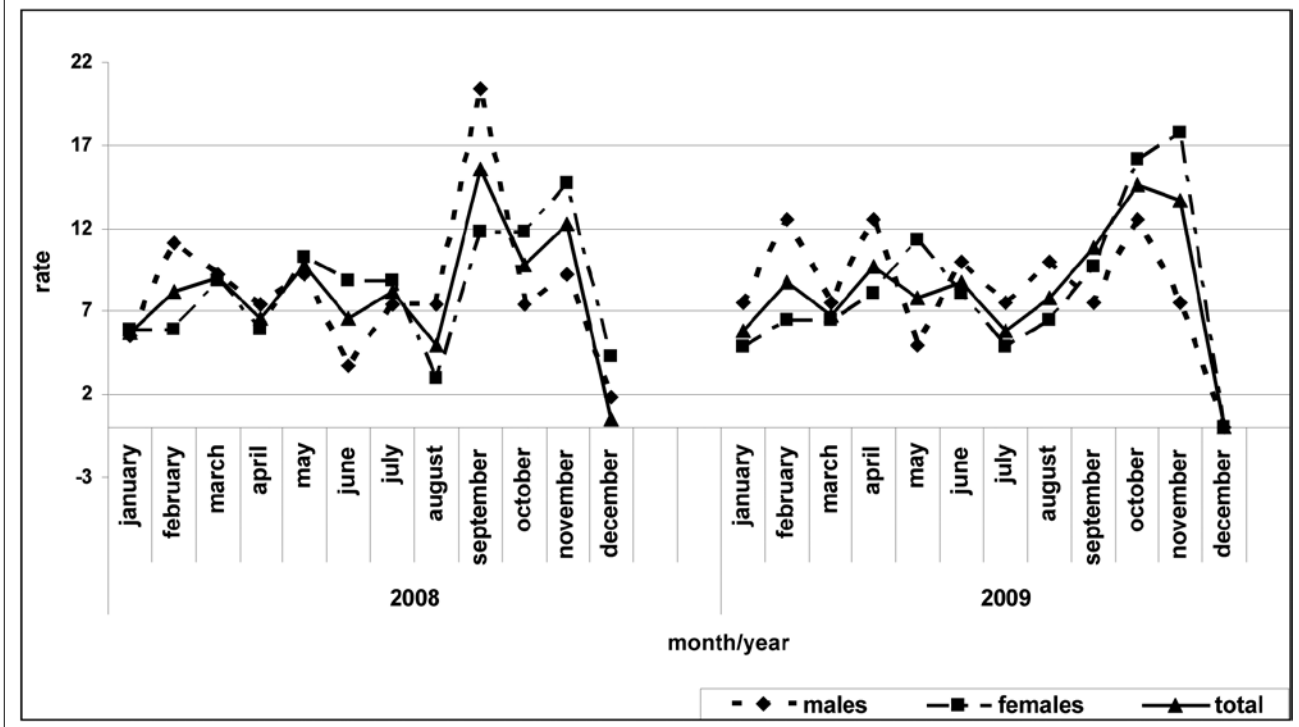
In order to report the results of the analysis, categorical variables were presented as numbers and percentages; the comparison between subgroups for qualitative data was carried out using Chi-square test. P values were considered significant when  $\leq 0.05$ .

## Results

In this study we analyzed 244 cases of access to a TUC. Of these 110 (45.9%) were males (M), and 134 (54.9%) females (F). The mean age was 45.1 (range 1.9-95.9) for males, and 43.9 (range 1.3-92.3) for females. The majority of patients were between 18 and 34 years old (31.6%), and between 35 and 51 years old (33.6%). Older patients, between 52 and 64 years old and those older than 65 were respectively 12.3% and 17.2%.

The distribution of the patients admitted to TUC by month during the two studied years is fairly constant, with a light and non significant rising prevalence between September and November, without significative difference between 2008 and 2009 and males and females (Fig. 1).

The triage code (distribution rate) in patients admitted to TUC by age and sex is shown in Table I. The majority of admission was yellow (45.9%) (M 40.1%, F 59.8%), followed by green (43.4%) (M 50.9%, F 49.0%), white (10.3%) (M 44%, F 56%) and red code (M 0%, F 0.04%). Red triage code was attributed to a

**Fig. 1.** Distribution rate of the patients admitted to TUC by month and sex (years 2008-2009).**Tab. I.** Triage code (distribution rate) in patients admitted to TUC by age class and sex.

| Age Class | Distribution rate (%) |     |       |      |       |      |       |     |      |      | Total |
|-----------|-----------------------|-----|-------|------|-------|------|-------|-----|------|------|-------|
|           | < 18                  |     | 18-34 |      | 35-51 |      | 52-64 |     | ≥ 65 |      |       |
|           | M                     | F   | M     | F    | M     | F    | M     | F   | M    | F    |       |
| Red       | 0                     | 0   | 0     | 0    | 0     | 0    | 0     | 0.4 | 0    | 0    | 0.04  |
| Yellow    | 0.4                   | 2.1 | 4.1   | 7    | 6.6   | 7.8  | 4.5   | 3.8 | 2.9  | 7    | 4.40  |
| Green     | 0.4                   | 1.6 | 9     | 9    | 8.2   | 6.2  | 2.1   | 0.8 | 2.5  | 3.7  | 4.35  |
| White     | 0.4                   | 0.4 | 1.2   | 17.2 | 2.1   | 16.8 | 0.4   | 5.3 | 0.4  | 11.5 | 5.57  |

M: males; F: females

\*Rate calculated among all the subjects belonging to the specific outcome category.

55 years old female with a pharmaceutical poisoning (benzodiazepines).

The distribution rate of the pattern of exposure is reported in Table II. The most frequently detected was ingestion (82.8% of cases), regarding in particular age classes 18-34 (27.9%) and 35-51 (25.8%) and less frequently subjects with years  $\leq 18$  (4.9%) or 52-64 (9.9%) and older 65 (14.4%). Food and drinks globally represents the 30.8% of ingested substances.

Ingestion pattern (Fig. 2) comprised caustic substances (25%), pharmaceutical products (18.4%), other agents as detergents and soap (11.9%), followed by drugs and substances of abuse (8.6%). The remaining 5.3% was represented by other and unknown agents.

Caustic substances are accounted respectively for 5.7% in men and 19.3% in females ( $p < 0.001$ ) and in these last ones a peak is shown among people between 18 and 51 years old.

Abuse of pharmaceutical substances (in particular psychoactive drugs, benzodiazepines and tranquillizers) was more frequent in women (13.9%) than in men (4.5%) ( $p < 0.001$ ) especially between 35 and 51 years old (4.9%); two cases were found in teenagers of 16 and 17 years old.

On the contrary, abuse of drugs substances concerned only males aged between 18 and 34 (4.5%) and between 35 and 51 (3.7%). In 42 cases (17.2%) the poisoning exposure was intentional, particularly in females (n. 34).

On arrival at the TUC the initial symptomatology was completely absent (57.4%) (M 27.9%, F 29.5%); very light/mild (25.8%) (M 8.4%, F 17.2%); severe (16.8%) (M 1.2%, F 1.6%).

In patients completely asymptomatic the distribution of the involved toxic substances ingested (the most frequent pattern of intoxication) by age classes and gender is shown in Figure 3. Ingestion of mushrooms was the

Tab. II. Distribution rate of the pattern of intoxication in patients admitted to TUC by age class and sex.

| Age Class  | Distribution rate (%) |     |       |      |       |       |       |     |      |     | Total |
|------------|-----------------------|-----|-------|------|-------|-------|-------|-----|------|-----|-------|
|            | <18                   |     | 18-34 |      | 35-51 |       | 52-64 |     | ≥ 65 |     |       |
|            | M                     | F   | M     | F    | M     | F     | M     | F   | M    | F   |       |
| Ingestion  | 0.8                   | 4.1 | 13.9  | 13.9 | 14.7* | 11.1* | 6.6   | 3.7 | 5.3  | 9.0 | 82.8  |
| Contact    | 0                     | 0   | 0.4   | 2.5  | 0.8   | 3.9   | 0.8   | 0.8 | 0.4  | 1.2 | 10.6  |
| Inhalation | 0.4                   | 0   | 0     | 0.8  | 1.2   | 2.7   | 0     | 0.8 | 0    | 1.2 | 7.0*  |

M: males; F: females; \*: p < 0.05 (males vs females)

\*Rate calculated among all the subjects belonging to the specific outcome category.

Fig. 2. Distribution of the involved toxic substances in all the patients admitted to TUC by age and sex.

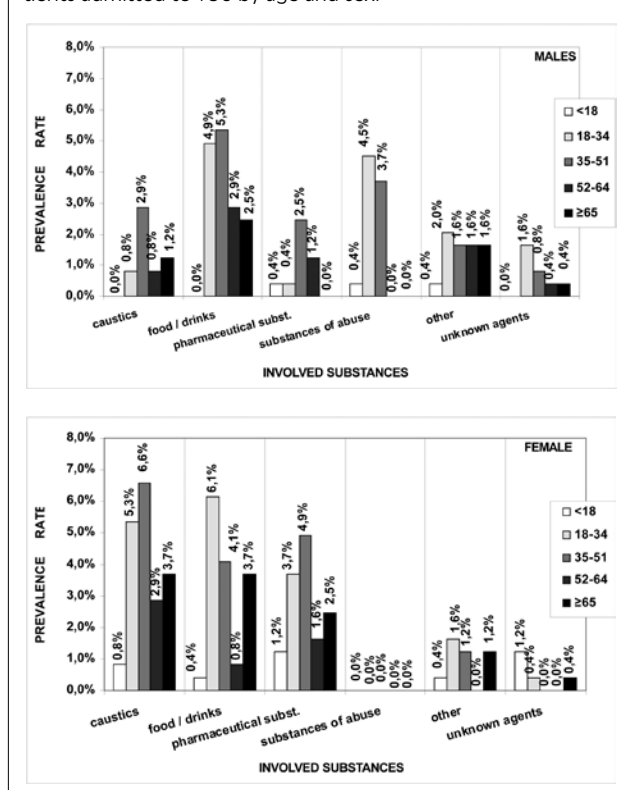
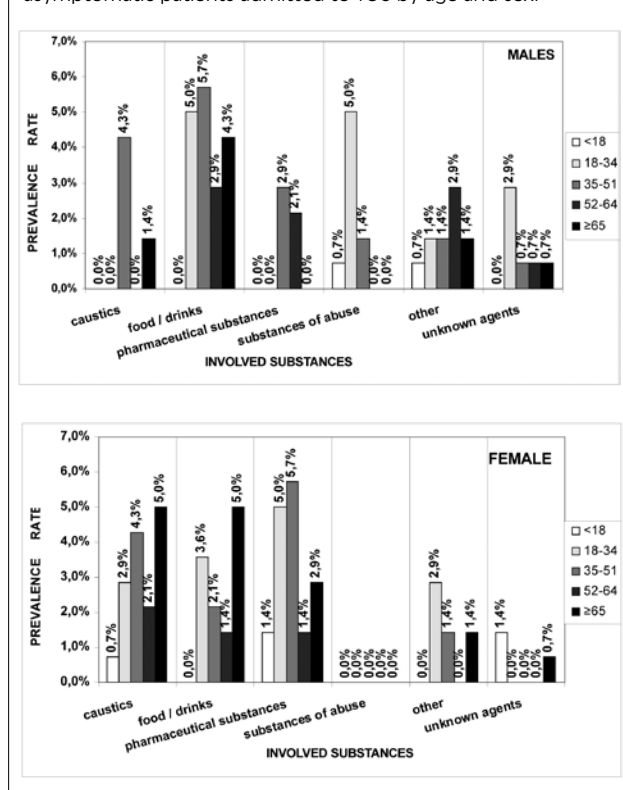


Fig. 3. Distribution of the involved toxic substances only in asymptomatic patients admitted to TUC by age and sex.



most common cause in both sexes (both 19.2%), ingestion of liquids involved predominantly males (17.9% vs. 12.1% in females, n.s.), while ingestion of pharmaceutical substances (16.4% vs. 5.0% in men, p < 0.0001) and of products like soap and detergents (7.9% vs. 5.7% in men, n.s.) involved predominantly women.

The distribution of the outcome of all patients according to the triage code is shown in Table III.

The most frequent outcome consist in patients sent to the general practitioner (63.5% of cases) or admitted to clinical rooms (surgery, medicine, psychiatry) (22.1% of cases).

The only red coded patient was admitted to intensive unit care and needed 10 days of hospitalization. The majority of yellow coded patients (45.5%) were sent to the GP but a 44.6% of them were admitted to clinical rooms for a maxi-

imum of two days (44.6%). The green coded (81.1%) and the white coded subjects (72.0%) were examined and were kept under observation for some time (range 1-12 hours) or immediately discharged and send to the GP.

### Discussion

This study tries to delineate the epidemiology of acute intoxications in a TUC placed in an Italian province in Northern Italy. Despite the exclusion of cases of alcohol poisoning (since overindulgence in alcohol is very common in this geographical area), the flow of patients appears constant and fairly substantial in the two studied years. The major cause of intoxication appears to be ingestion: firstly of food and caustics, followed by detergents, phar-

Tab. III. Outcome distribution rate of the patients admitted to TUC by sex and triage code.

| Outcome      | Admission to clinical room % |      | Sent to GP % |      | Discharged % |     | Refused treatments % |     | Voluntarily go away % |     |
|--------------|------------------------------|------|--------------|------|--------------|-----|----------------------|-----|-----------------------|-----|
|              | M                            | F    | M            | F    | M            | F   | M                    | F   | M                     | F   |
| Sex          |                              |      |              |      |              |     |                      |     |                       |     |
| Triage code  |                              |      |              |      |              |     |                      |     |                       |     |
| Red          | 0                            | 0.4  | 0            | 0    | 0            | 0   | 0                    | 0   | 0                     | 0   |
| Yellow       | 7.4                          | 13.1 | 7.8          | 13.1 | 0.8          | 0.4 | 0.4                  | 0.4 | 2.1                   | 0.4 |
| Green        | 1.2                          | 0    | 17.6         | 17.6 | 2.5          | 1.6 | 0                    | 0.8 | 0.8                   | 1.2 |
| White        | 0                            | 0    | 2.9          | 4.5  | 0.8          | 0.8 | 0                    | 0   | 0.8                   | 0.4 |
| Total        | 8.6                          | 13.5 | 28.9         | 35.3 | 4.1          | 2.9 | 0.4                  | 1.2 | 3.7                   | 2.1 |
| Total M+F    | 22.1                         |      | 63.5         |      | 7.0          |     | 1.6                  |     | 5.7                   |     |
| Total (M;F)* | (38.9;62.1)                  |      | (44.5;55.5)  |      | (58.8;41.2)  |     | (25.0;75.0)          |     | (64.3;35.7)           |     |

M: males; F: females.

\*Rate calculated among all the subjects belonging to the specific outcome category.

maceuticals or drugs of abuse. The increase of TUC assistance in autumn is partially related to the consumption of mushrooms, which are sometimes picked up without any competence creating a serious health or life danger. Early diagnosis and treatment of real or suspected mushroom poisonings (which sometimes presents an initial poor symptomatology) can save lives or avoid irremediable health damages. Moreover creating a collaborative network with a mycologist team can improve toxic mushroom identification for a better clinical output [10]. Public awareness is very important for the prevention of intoxication and for encouraging early admission to hospitals. The surveillance in an appropriate structure such as a TUC appears at least adequate if not absolutely desirable, because of the presence of specialized personnel and the chance of receiving the most appropriate treatments [10]. The prevalent age classes involved were that between 18 and 51 years old probably due to inattention or to lack of time, and people older than 65 owing to their longer stay at home, where domestic works allow a longer contact with household products. In fact, in this study poisoning by ingestion and contact with detergents and caustics represents the second biggest cause of intoxication [11]. Though cleaning products are very effective for cleaning home and produce substantial perceived benefits, their improper use might be associated with adverse health outcomes [12-14]. These products contain active ingredients that can cause different types of toxicity upon mishandling, improper storage, or extensive daily use. For some substances, even in small amounts, inhalation may cause acute lung injury, contact may produce caustic damages, ingestion may lead to acute aero-digestive lesions. Depending on the cleaning agent, the route, the dose and/or the duration of exposure to cleaning products can also produce toxicity both on short term and/or on chronic bases [12]. Women are still the most affected by this intoxication, because they usually stay longer than men at home and because they are more involved in domestic cleaning. They easily breathe or get in contact with one or a mixture of more toxic products such as the so-called "maid mix" [14, 15]. This fact points out that

a correct and a widespread information about dangers and a correct use of household products is essential, also supported by an appropriate organization of domestic spaces, in particular in houses where children live. The abuse of pharmaceutical products and drugs is an important cause of accessing to TUC. Pharmaceutical intoxications concern in most cases women (firstly 35-51 years old, secondarily 18-34 and  $\geq 65$  years old) who in most cases assume intentionally a big amount of pills, especially sedative/hypnotics or antipsychotics that they have at home, often with a self-destructive purpose. Young men are instead more involved than women in use and abuse of street and stimulant drugs [8, 9]. In most cases the assigned triage code resulted yellow (urgency condition) and green (less urgency condition). Considering that the seriousness of the symptoms in all its severity can appear after several hours from exposure to toxic substances, waiting for their appearance for a specific intervention could be dramatically late. In fact, patients arrive at the ED even when there is just a possible exposure to a toxic substance and these people need to be monitored all the same [16]. This fact may explain the apparent discordance between the amount of patients with triage codes that identify an initial non urgent treatment and the relatively relevant rate (over 22%) of them admitted later to clinical rooms. Reorganizing the reception protocols for the patients and assigning immediately and automatically at least the yellow triage code would be more correct, in order to create a sort of reserved lane to receive at once a doctor diagnosis to identify the potentially evolutive situations as serious and dangerous. So the timely medical examination allows the activation, if necessary, of all the immediate therapeutic intervention (decontamination by poison, preventing its further absorption, use of antidote if possible) to obtain a substantial improvement in the prognosis and to prevent the progression to some very serious damage, often irreversible and sometimes fatal [17]. Fortunately, in the majority of the observed patients the symptomatology of acute intoxications were benign. In most cases the procedure ended with the patient being sent to a GP directly or after a period of surveillance (with or without therapy).

Even if this study was conducted in a relatively short period of time, it permits to delineate a first epidemiological profile of the local reality. These data demonstrate the importance of diagnosis and public health care, in particular with appropriate and specialized intervention such as those of a TUC.

Epidemiological studies on AI conducted in TUC distributed in wide geographical area demonstrate the utility of clinical and epidemiological ad hoc surveys, help to outline better the social weight of dangerous types of voluntary or transgressive behaviors - sometime simply due to lack of caution- and can also improve the knowledge of many parameters to implement and specialize first care and specific programs of prevention [18].

Poison centers detect a large number of toxic exposures and poisonings from asymptomatic ones to major ones, collecting information about the agents of poisoning, the patient's condition and the circumstances of exposure [19-21]. Therefore they are in a unique position to monitor the pattern, the incidence and the severity of exposures to toxic substances and to detect new trends and emerging patterns in human toxicology. They can

also mark risk factors in vulnerable population such as changes in drug patterns, unusual pattern of addiction, unexpected product users, particular behaviors at risk at home or at work, groups at risk (children, old people, particular workers) and undetected sources of environmental contamination.

Data analysis could lead in the future to an agreement about standardization of codes and diagnosis which would be fundamental and would permit to consider AI on national and international scale.

Moreover, this analysis empathizes the importance of prevention, with education and information of people, especially about dangers of products frequently used at home (detergents, caustic substances, chemicals) [18]. The primary mission of Poison Centers has always been an improvement in poisoned patient's care and in prevention of poisoning cases which led to a reduction in disabilities and costly long-term medical care.

National programs for prevention of poisonings are crucial to reduce their number at home or at work, to detect and eliminate unusually hazardous commercial products and to limit the overuse of emergency systems.

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