REUE | Original Article

Suicide attempts by poisoning and other means: distinguishing characteristics

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OBJECTIVES. To identify possible differences between attempted suicides by poisoning and attempts by other methods. To describe possible predictors of the use of poisons, and to determine the most commonly used substances.

METHODS. Descriptive retrospective observational study of patients attempting suicide between January 2018 and July 2021 who were treated in the emergency and psychiatric departments of a tertiary care teaching hospital. We analyzed differences between poisoning and non-poisoning cases based on data extracted from records as follows: referral source, history of psychiatric disease and substance abuse, prior suicide attempts, existence of a written suicide note, and signs and symptoms.

RESULTS. A total of 653 suicide attempts were on record. The majority (87.6%) involved a poisonous substance. Differentiating characterics were sex (70.6% of women used a poison and 55.6% of men used a different method, $P < .001$). The majority in both groups were Spanish (71.2% and 58%, $P = .021$), and a history of a psychiatric illness was high in both (84.6% and 80.2%). Risk factors for using a poison included female sex and a history of addiction. On the other hand, a history of having a psychotic episode was inversely associated with use of a poison.

CONCLUSIONS. Differences between people who attempt suicide by poisoning and those who use another method include sex, nationality, and certain aspects of psychiatric history.

Keywords: Hospital emergency department. Suicide, attempted. Suicide. Poisoning.

Intoxicaciones e intentos de suicidio: características diferenciales con los intentos autolíticos no toxicológicos

OBJETIVOS. Identificar posibles diferencias en los intentos de suicidio en función del uso de tóxicos u otros métodos, describir posibles factores predictivos de utilización de un método toxicológico y determinar los tóxicos más utilizados.

MATERIAL Y MÉTODO. Estudio observacional descriptivo retrospectivo de los pacientes que consultaron por intento de suicidio entre enero de 2018 y julio de 2021 en los servicios de urgencias médicas y psiquiátricas de un Hospital Universitario de tercer nivel. Se analizaron las diferencias según hubieran utilizado un método toxicológico o no toxicológico. Se recogieron datos demográficos, antecedentes psiquiátricos y de consumo de sustancias, intentos previos de suicidio, redacción de carta de despedida y presencia de clínica.

RESULTADOS. Se registraron 653 pacientes por tentativa de suicidio. La mayoría empleó un método toxicológico (87,6%). Existieron diferencias en el sexo (70,6% de mujeres en el método toxicológico y 55,6% de varones en el no toxicológico; $p < 0,001$). En ambos grupos había mayoría de españoles (71,2% *vs* 58%; $p = 0,021$) y antecedentes de enfermedad psiquiátrica (84,6% *vs* 80,2%). Los factores que predicen el uso de un método toxicológico son el sexo femenino y los antecedentes de trastorno adictivo. En cambio, los antecedentes de trastorno psicótico se asocian negativamente con el uso de tóxicos.

CONCLUSIONES. Existen diferencias en los intentos de suicidio entre grupos según el método empleado, fundamentalmente el sexo predominante, la nacionalidad y determinados antecedentes psiquiátricos.

Palabras clave: Urgencias hospitalarias. Intento de suicidio. Suicidio. Intoxicación.

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Introduction

The World Health Organization (WHO) recognizes suicide as a public health priority. It is estimated that around 700,000 people take their own lives each year worldwide, and that this figure multiplies by 20 when including suicide attempts.[1,2] A non-fatal suicide attempt is the most important individual risk factor for completed suicide.[3,4]

According to data from the National Institute of Statistics (INE),[5] in 2020, deaths by suicide in Spain reached their highest number since records began. They represented the leading cause of unnatural death in 2020 and the second leading cause of death among young people aged 15 to 29 years. If to the completed suicides—where toxic substances are present in more than 75% of cases[6]—we add suicide attempts and suicidal ideation, it is estimated that around 80,000 suicide attempts could occur in Spain each year.[1,2]

During 2020, marked by the pandemic caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), a total of 3,941 completed suicides were reported. This represents an increase of 7.35% compared with the previous year, very likely as a consequence of the effects that the pandemic had on the population's mental health.[7,8] Although suicide rates decreased or remained practically unchanged during the first months of the pandemic,[9] an increased suicide risk was observed starting from the second wave.[10-13]

Hospital emergency departments receive daily patients who have attempted suicide, with an estimated rate of 76.1 suicide attempts per 100,000 inhabitants per year.[12] The mechanism used to carry out these attempts varies, including toxicological and non-toxicological methods. The method employed depends on multiple factors—personal, professional, family, ethnic, and social.[3,4] The objective of this study was to identify possible differences in patient characteristics depending on the mechanism used in the suicide attempt, to identify potential predictive factors for the use of a toxicological method, and to describe the toxic substances used by patients who attempted suicide through toxic means.

Material and methods

We conducted a retrospective, descriptive, observational study including all patients who presented to medical and psychiatric emergency departments for suicide attempts at a tertiary university hospital from January 2018 through July 2021. Data were obtained from a review of health records. For each patient, demographic data, type of attempt (toxicological vs non-toxicological), psychiatric history, substance use history, prior suicide attempts, presence of a farewell note, clinical presentation at admission, treatment received, and discharge disposition were collected.

In cases where the possible presence of drugs of abuse in urine was investigated, this was determined by solid-phase reactive test strips (BIOSIGMA). The involvement of drugs and alcohol was established through clinical history and plasma level determination for some drugs. The study was approved by the institutional Ethics Committee.

For statistical analysis, STATA software version 15.1 (StataCorp, College Station, TX, USA) was used. Results are expressed as mean (SD) and percentage. Student's t test was used for mean comparison, and Pearson's chi-square test—with Fisher's correction when necessary—was used for proportion comparison. A multivariate analysis was performed to determine which factors were independently associated with the use of a toxicological method. Variables that were significant in the bivariate analysis were included. Odds ratios (OR) and their 95% confidence intervals (CI) were calculated for variables independently associated with the use of a toxicological method. A P value < .05 was considered statistically significant.

Results

During the study period, a total of 653 suicide attempt cases were recorded, of which 572 used a toxicological method (87.6%) and 81 a non-toxicological method (12.4%). Results are shown in Table 1. There were statistically significant sex differences: among toxicological methods, most patients were women, whereas among non-toxicological methods, males predominated (70.6% women in the first group vs 55.6% men in the second; P < .001). The mean age was 39.4 (15.9) years in the toxicological group and 37.5 (17.9) years in the non-toxicological group (P = .33). The most frequent nationality among patients using toxic substances was Spanish (71.2%), followed by Latin American (12.9%), Western European (7.3%), and Maghrebian (3.3%). Among those using non-toxicological methods, Spanish nationality was also the most common, though at a lower percentage (58%), followed by Latin American (19.8%), Maghrebian (7.4%), and Western European (7.4%) (P = .021) (Figure 1).

Regarding psychiatric history, no significant differences were found between the 2 groups. Psychiatric antecedents were present in 484 patients using a toxicological method

Table 1. Patient characteristics according to the method used in the suicide attempt

	Toxicological N = 572 n (%)	Non-toxicological N = 81 n (%)	Total N = 653 n (%)	*P*-value
Age (years) [mean (SD)]	39.4 (15.9)	37.5 (17.9)	39.1 (16.2)	.335
Sex				< .001
Female	404 (70.6)	36 (44.4)	439 (67.5)	
Male	168 (29.4)	45 (55.6)	211 (32.5)	
Spanish nationality	407 (71.2)	47 (58)	454 (69.5)	**.021**
Farewell letter	31 (5.4)	1 (1.2)	32 (4.9)	.102
History of psychiatric disorder	484 (84.6)	65 (80.2)	549 (84.1)	.315
Depressive disorder	309 (54)	38 (46.9)	347 (53.1)	.230
Anxiety	230 (40.2)	25 (30.9)	255 (39.1)	.107
Eating behavior disorder	39 (6.8)	2 (2.5)	41 (6.3)	.131
Addictive disorder	208 (36.4)	21 (25.9)	229 (35.1)	.065
Psychotic disorder	50 (8.7)	14 (17.3)	64 (9.8)	**.016**
ADHD	11 (1.9)	6 (7.4)	17 (2.6)	**.004**
Personality disorder	160 (28)	22 (27.2)	182 (27.9)	.879
History of substance use	250 (43.7)	34 (42)	284 (43.5)	.488
Previous suicide attempt	304 (53.1)	40 (49.4)	344 (52.7)	.525

SD: standard deviation; ADHD: attention deficit hyperactivity disorder.

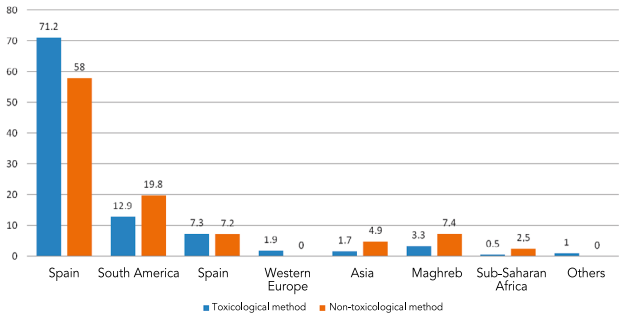

Figure 1. Origin of patients with suicide attempts (data in percentages).

(84.6%) and in 65 patients using a non-toxicological method (80.2%) (P = .31). However, among patients using a toxicological method, there was a lower percentage of individuals with psychotic disorder (8.7% vs 17.3%; P = .016) and attention deficit hyperactivity disorder (1.9% vs 7.4%; P = .004). Although the remaining psychiatric disorders showed no significant differences, the 2 groups exhibited a high percentage of depressive disorder (54.0% vs 46.9%). No differences were found in the percentage of patients with a past medical history of substance use, previous suicide attempts, or the presence of a farewell letter. Among all patients with suicide attempts, 284 (43.5%) had a past medical history of substance use, and 344 (52.7%) had previously attempted suicide on at least one occasion.

Clinical signs (Table 2) were more frequent among patients using toxicological methods (60.3% vs 30.9%; P < .001), especially neurological (50.3% vs 13.6%; P < .001) and digestive symptoms (11.9% vs 1.2%; P = .004). Pharmacological treatment was administered only to those who used toxic substances: 35.7% received activated charcoal and 17.7% received antidotes (P < .001).

Regarding patient disposition, always after psychiatric evaluation, in the toxicological group, 45.3% were discharged directly from the emergency department within the first 12 hours after admission—a significantly lower percentage than those using non-toxicological methods (70.4%; P < .001). However, 15% of patients using a toxicological method required psychiatric admission vs 6.2% of those using non-toxicological methods (P < .001) (Figure 2). Mortality was low: 3 patients died during hospitalization (0.5%)—2 in the non-toxicological group and 1 in the toxicological group, due to ingestion of both multiple and illegal drugs (P = .048).

Among toxicological methods, the most frequently used were drugs (90.6%), primarily benzodiazepines (61%) and antidepressants (25%). Alcohol was present in 25.3% of cases, and drugs of abuse in 7.7%. A combination of drugs and alcohol was found in 116 cases, representing 22.4% of patients who ingested drugs. Among non-toxicological methods, the most frequent was phlebotomy (63.6%), followed by jumping from a height (15.7%) (Table 3).

Among patients who had used a toxicological method, 59 (9% of the total) also used non-toxicological methods simultaneously. The analysis of this subgroup did not show differences compared with the toxicological group.

Table 2. Presence of clinical signs and need for treatment according to the method used in the suicide attempt

	Toxicological N = 572 n (%)	Non-toxicological N = 81 n (%)	Total N = 653 n (%)	*P*-value
Presence of clinical signs	345 (60.3)	25 (30.9)	370 (56.7)	< .001
Neurological	288 (50.3)	11 (13.6)	299 (45.8)	< .001
Respiratory	32 (5.6)	7 (8.6)	39 (6.0)	.279
Cardiovascular	30 (5.2)	6 (7.4)	36 (5.5)	.425
Digestive	68 (11.9)	1 (1.2)	69 (10.6)	.004
Behavioral alterations	60 (10.5)	11 (13.6)	71 (10.9)	.403
Treatment	260 (45.5)	4 (4.9)	264 (40.4)	< .001
OTI-MV	15 (2.6)	4 (4.9)	19 (2.9)	.246
Activated charcoal	204 (35.7)	0 (0.0)	204 (31.2)	< .001
Antidote	101 (17.7)	0 (0.0)	101 (15.5)	< .001

OTI-MV: orotracheal intubation with mechanical ventilation.

The results of the multivariate analysis are shown in Table 4. The only 2 variables independently associated with the use of a toxicological method in suicide attempts were female sex (OR, 3.86; 95%CI, 2.33–6.40; P < .001) and a history of addictive disorder (OR, 2.35; 95% CI, 1.30–4.27; P = .005). Conversely, a history of psychotic disorder was negatively associated with the use of toxic substances in suicide attempts (OR, 0.32; 95% CI, 0.16–0.65; P = .002).

Discussion

Our results show that nearly 90% of patients treated in the emergency department for suicide attempts used a toxicological method. Of note, patients treated in emergency departments are those with non-fatal attempts, and that toxicological methods are probably less expeditious than non-toxicological ones, which may explain their higher prevalence. Most patients treated were women, with psychiatric histories and a mean age of around 40 years. A higher prevalence of the use of toxic substances as the main method in suicide attempts has already been described in other studies. In 2 of them,[13,14] which analyzed mortality from suicide, toxic substances were found to be the most frequent method, followed by jumping onto railway tracks. In another study[15] on suicide attempts in the pediatric population, a predominance of toxicological methods was also observed.

In the 2 groups, most patients were of Spanish nationality, but among those who used toxic substances, 12.9% were from Latin America, 7.3% from Western Europe, and only 3.3% from the Maghreb. In contrast, among patients who did not use toxicological methods, those from the Maghreb were twice as frequent (7.4%). It is likely that religious and cultural aspects influence the tendency of the Maghreb population to use non-toxicological methods more often. In a Moroccan study, falls were the main method of suicide attempt.[16]

A high percentage of patients presented depressive disorder, substance use history, and former suicide attempts, with no significant inter-group differences. These findings are consistent with a former study,[11] in which nearly three-quarters of patients treated in emergency depart-

Table 3. Toxicological and non-toxicological methods used in suicide attempts

Toxicological methods n (%)			
Alcohol	145 (25.3)	**Drugs**	**518 (90.6)**
Drugs	44 (7.7)	Benzodiazepines	349 (61.0)
Cocaine	23 (4.0)	Neuroleptics	82 (14.3)
Cannabis	12 (2.1)	Antidepressants	143 (25.0)
Ecstasy	4 (0.7)	Opioids	**21 (3.7)**
Amphetamines	6 (1)	Paracetamol	53 (9.3)
GHB	1 (0.2)	NSAIDs	**66 (11.5)**
Methadone	7 (1.2)	Antiarrhythmics	8 (1.4)
Heroin	5 (0.9)	Antiepileptics	**56 (9.8)**
		Hypoglycemics	**8 (1.4)**
Household products		**Gases**	4 (0.7)
Bleach	9 (1.6)	Carbon monoxide	4 (0.7)
Hydrochloric acid (muriatic acid)	2 (0.3)		
Dishwashing liquid	2 (0.3)		
Rodenticides	1 (0.2)		
Non-toxicological methods n (%)			
Phlebotomy		89 (63.6)	
Jumping from a height		22 (15.7)	
Jumping onto subway/train tracks		3 (2.1)	
Hanging		11 (7.9)	
Sharp weapon		4 (2.9)	

GHB: Gamma-hydroxybutyric acid; NSAIDs: Non-steroidal anti-inflammatory drugs.

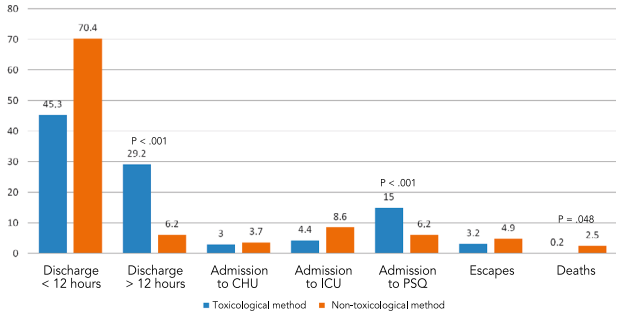

Figure 2. Distribution of discharge destinations from the emergency department according to the method used in the suicide attempt (data in percentages).
CHU: conventional hospitalization unit; ICU: intensive care unit; PSQ: psychiatry service.

ments for a suicide attempt had a psychiatric history, and half had made a previous attempt. The relationship between suicidal behavior and psychiatric history is well established, and the presence of previous attempts has been identified as the main risk factor for completed suicide.[7,17-19] However, among patients who used a toxicological method, there was a lower percentage of individuals with psychotic disorder and attention deficit hyperactivity disorder (ADHD). Difficulties with concentration and learning have already been described by other authors as risk factors for suicide attempts, although not associated with any particular method.[20] Psychosis is closely related to an increased risk of self-injurious behavior. This, together with the clinical characteristics of the disorder *per se*, could explain the greater likelihood of using non-toxicological methods in a suicide attempt.[21]

Regarding the signs and symptoms presented by patients and the need for treatment, differences were observed in clinical signs—mainly neurological and digestive—in the group that used a toxicological method. They also required medical treatment more frequently. This difference was expected, since the higher proportion of symptoms is likely due to the pharmacological or toxic effects of the substances ingested, as described in other studies.[17] Similarly, patients who ingested toxic substances more often required medical treatment, as the type of substance and time since ingestion may require antidotes or GI decontamination.

Most patients were discharged directly from the emergency department. As in former studies,[19,22] psychiatric admissions were more frequent among individuals who used toxic substances, which may imply a lesser somatic impact of suicide attempts using this mechanism. Conversely, intensive care unit (ICU) admissions were more frequent among those who used non-toxicological methods. This may be because patients who use toxic substances typically require less aggressive treatments and recover more quickly, allowing direct admission to psychiatry if needed. In contrast, non-toxicological methods often cause severe injuries that may require surgical intervention and ICU admission. Regarding deaths, these data must be interpreted with caution, since this study only analyzed hospitalized patients, and deaths occurring at the scene were not included—thus, they did not reach the hospital.

The most frequently used substances among patients employing toxicological methods were drugs, mainly benzodiazepines and antidepressants, which is consistent with other reports.[15] Notably, more than one-fifth of patients who ingested drugs also consumed alcohol, which may enhance the sedative effects of benzodiazepines, neuroleptics, and other drugs with central nervous system depressant properties.

The multivariate analysis identified sex, addictive disorder, and psychotic disorder as independent factors related to the use of toxicological methods. Female sex—predominant among patients with suicide attempts[12]—was shown in this study to be associated with toxic substance use. Regarding psychiatric history, the presence of an addictive disorder in a suicide attempt was associated with more than double the risk of using toxic substances. Interestingly, the use of illicit drugs as a direct suicide method was rare, with drugs being the most widely used among those with addictive disorders. Conversely, for every 100 individuals with a psychotic disorder who attempted suicide, only 32 used toxic substances. As mentioned above, there is a negative association between psychotic disorders and the use of toxicological methods. None of the other analyzed variables reached statistical significance in the multivariate analysis. No nationality showed a clear association with the method used. However, even in the absence of statistical significance, Spanish patients tended to use toxicological methods,[13-15] while Latin American patients tended to use non-toxicological methods. This trend in the Latin American population had been described previously in another publication,[23] though in relation to suicide mor-

tality, where the most common methods were firearms and instruments causing asphyxia.

The main limitations of this study are as follows: the use of health records as a data source is a quick, simple, and cost-effective method, but records may be incomplete or lack accurate documentation of certain aspects. In addition, due to the retrospective design of the study, some suicide attempts may not have been detected. Another limitation is the single-center design, which makes it difficult to generalize findings to other settings or geographic areas.

An important point is that the study period included months of confinement, pandemic, and post-pandemic due to SARS-CoV-2, which may have led to changes in the trends and characteristics of suicide attempts that are difficult to interpret.[8] Although numerous studies relate the pandemic to an increase in suicide attempts,[8,11] multicenter studies are needed to clarify the real influence of the pandemic on suicide attempts. Suicide is a major public health problem. Systematic data collection and analysis of information obtained from patients treated in emergency departments can provide an updated and realistic view of suicide attempts, which may aid in developing prevention plans. Understanding the differing characteristics of patients according to the method used in suicide attempts may assist clinicians in their management. Furthermore, recognizing risk factors allows for closer follow-up and greater attention to potential triggers. Thus, through protocols and interventions based on this knowledge, it may be possible to prevent the continued rise in completed suicides.

In conclusion, the use of toxic substances is more frequent than other methods among patients presenting to emergency departments for suicide attempts, and these patients are mostly women. Prospective, multicenter studies with an adequate number of patients and a design allowing follow-up are needed to provide greater external validity.

Table 4. Independent factors associated with the use of toxicological methods in a suicide attempt

	OR	IC 95%	*P*-value
Sex, female	3.86	2.33-6.40	< .001
Addictive disorder	2.35	1.30-4.27	.005
Psychotic disorder	0.32	0.16-0.65	.002

OR: Odds ratio; IC: 95%: confidence interval of95%.

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