

Suicide attempts by exposure to toxic agents registered in a Toxicological Information and Assistance Center in Fortaleza, Ceará, Brazil, 2013

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Abstract

Objective: to describe cases of suicide attempts by exposure to toxic agents registered by the Toxicological Information and Assistance Center in Fortaleza, Ceará, Brazil. **Methods:** this is a descriptive study using secondary data of the cases registered in 2013. **Results:** 410 cases were registered; 56.2% of the individuals were female and 79.7% were between 12 and 39 years old; most of them (86.4%) lived in urban areas and 67.2%, in Fortaleza; in 94.9% of the cases, the exposure took place in the individual's own home; the toxic agents most commonly used were pesticides (42.9%), especially for agricultural use (30.2%), medicines (39.5%) and house cleaning products (3.4%); of 16 suicide attempts that resulted in death, 15 were caused by agricultural pesticides. **Conclusion:** the study shows that the intake of toxic agents, especially of agricultural pesticides, is a common method used in suicide attempts; the integration between actions of promotion and prevention are essential.

Key Words: Suicide Attempted; Pesticides; Poisoning; Information Centers; Epidemiology, Descriptive.

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Introduction

Suicide attempts are a serious Public Health issue.¹ According to the World Health Organization (WHO),² the term "suicide attempt" indicates any type of non-fatal suicidal behavior, referring to intentional self-inflicted poisoning, self-mutilation and other injuries that may or may not have death as its objective or outcome. Suicide is the deliberate act of killing oneself.²

For each suicide case, there are many suicide attempts every year.^{1,3} There were approximately 804,000 suicides worldwide in 2012, which indicates an annual global age-standardized suicide rate of 11.4 per 100,000 inhabitants (15.0 for males and 8.0 for females).²

Suicide attempts constitute a social and economic burden on the community, due to the use of health services for treatment, the social and psychological impact on the individual's behavior, and, occasionally, long term disabling sequelae.

In Brazil, data regarding suicide attempts are more limited and less trustworthy than those regarding suicides.^{1,3} Suicide attempts were only inserted in the national list of compulsory notifiable diseases in 2014, with the publication of Ministerial Act GM/MS No. 1,271 dated June 6th, 2014.⁴

Suicide is the 15th most common cause of death in the world. Although suicides are relatively rare in the general population, suicide rates are higher among groups of people with mental disorders.⁵ Social, cultural, psychological, and other factors may interact, leading the individual to suicidal behavior.^{6,7} However, many suicide cases happen impulsively and, in those circumstances, easy access to the means to that end may be the difference between one person's life and death.¹

Pesticide intake, hanging and firearms are amongst the most common suicide methods worldwide, although the choice of method varies, frequently, according to the population group.^{1,8}

The use of toxic agents is among the main methods used in suicide attempts. In Brazil, 137,189 cases of suicide attempts by using toxic agents were registered by Brazilian Toxicological Information and Assistance Centers, from 1997 to 2005. Although medication

has been more frequently involved (57.3%) in those occurrences, the fatality rate associated to them (0.5%) was smaller when compared to other types of toxic agents, such as rodenticides (1.97%) and other pesticides (4.9%).³

Suicide attempts constitute a social and economic burden on the community, due to the use of health services for treatment, the social and psychological impact on the individual's behavior, and, occasionally, long term disabling sequelae.² More importantly, a previous suicide attempt is the strongest predictor of a death by suicide.⁹

Among other predictors of the recurrence of a suicide attempt, we may highlight: sexual abuse, psychiatric disorder, psychiatric treatment, depression, anxiety, alcohol abuse or dependency.⁹ Mendez-Bustos et al.¹⁰ pointed that the highest suicide attempt recurrence rates were associated with the following aspects: unemployment; being single; mental illness diagnosis; suicidal ideation; stressful events; and family history of suicidal behavior.

The identification of those individuals at high risk and the provision of care and follow-up should be essential components of any comprehensive suicide prevention strategy.^{9,10}

By assessing the studies that show the results of at least one of the following outcomes: suicide ideation, suicide attempts and suicide, Du Roscoat and Beck¹¹ presented that, among others, the three most efficient categories of intervention seem to be the limitation of access to lethal means, the preservation of contact with other patients hospitalized for a suicide attempt, and the implementation of emergency call centers.

Understanding the local reality and pondering over the generated information is important in order to contribute to the construction of adequate strategies of life promotion and suicide attempts prevention. The aim of the present study was to describe the cases of suicide attempts by exposure to toxic agents registered in a Toxicological Information and Assistance Center in Fortaleza, Ceará, Brazil, in 2013.

Methods

This is a descriptive study of the suicide attempts by exposure to toxic agents registered in a Toxicological Information and Assistance Center (CEATOX) in Fortaleza, 2013.

CEATOX operates at the City Hospital Institute Dr. José Frota (IJF), in constant emergency service, in 24-hour shifts, 7 days a week, integrated to the other hospital services, especially along with emergency room and the clinical analysis laboratory. CEATOX provides face-to-face medical care to individuals exposed to toxic agents and/or poisoned individuals, along with IJF doctors, and provides information to specialists in other units by telephone. Its activities are developed by a team of professionals composed of a coordinator (doctor) and technicians (pharmacists), also supported by the help of interns (undergraduate Medicine and Pharmacy students).

Data were extracted from the record sheets used by CEATOX/IJF when registering for treatment. Cases that occurred from January 1st to 31st December of 2013 were included.

Among all the cases of exposure to different toxic agents groups (pesticides, medication, house cleaning products, abuse drugs and others) registered by CEATOX/IJF and which occurred in various circumstances (accidents, occupational exposure, abuse, suicide attempt and others), only the cases of suicide attempts were used in this study. All the other cases of exposure to toxic agents apart from the aforementioned were excluded.

The variables studied were: toxic agent groups involved in the exposure (pesticides [Classification done according to CEATOX/IJF forms of notification and treatment]); medication (Anatomical Therapeutic Chemical Classification [ATC])¹² and household cleaning products); sex (male or female); profession/occupation (student, housewife, unemployed, farmer, other); individual's municipality of residence (Fortaleza, Caucaia, Maranguape, Maracanaú, Aquiraz, Morada Nova, Limoeiro do Norte, Paracuru, Eusébio, Guaiúba, São Gonçalo do Amarante and others); municipality area (area where the exposure to toxic agents occurred, which may be rural, urban or ignored [when it was not possible to identify the area where the incident occurred]); place where the exposure occurred (home, outdoor environment, workplace, work route, school/daycare, others); via (oral, dermal, others); clinical manifestations due to exposure to the toxic agent (yes or no); hospitalization (yes or no); outcome (cure, non-confirmed cure, sequelae, death, death by other cause, other); and age, grouped in age groups (in years).

Descriptive statistical analysis was performed, with the use of Epi Info for Windows 3.5.4, which was also used for typing the data for analysis.

The requirements regarding confidentiality and secrecy of information, according to the recommendations by Resolution of the National Health Council (CNS) No. 466, dated December 12th, 2012,¹³ were respected. The research project was approved, according to CAAE number 18640013.9.0000.5054 by the Human Research Ethics Committee of the Federal University of Ceará (UFC), in November 2013.

Results

CEATOX/IJF registered 410 cases of suicide attempts by exposure to toxic agents, which correspond to 11.1% of a total of 3,707 cases of human exposure to different types of toxic agents registered in 2013. The most used toxic agents in suicide attempts were pesticides (42.9%), mainly for agricultural use (30.2%), medication (39.5%) and house cleaning products (3.4%). In 14.2% of the cases, the simultaneous use of two or more toxic agents belonging to different groups was reported, as presented in Table 1.

Among the 176 cases concerning the intake of pesticides, the most frequent were agricultural pesticides (70.4%), followed by rodenticides (19.3%), pesticides of veterinary use (6.3%) and pesticides for household use (4%) (Table 1) "Chumbinho", a product which probably has aldicarb as its active ingredient, a pesticide belonging to the class of carbamate insecticides, was responsible for 56.8% of the 176 cases, while coumarin rodenticides were responsible for 17.6% of the cases.

As for medication intake, there were 162 cases registered involving 309 medicines; 78 individuals (48.1%) used two or more medicines simultaneously when attempting suicide.

With the use of Anatomical Therapeutic Chemical Classification – ATC –, it was possible to gather 95 drugs used in the suicide attempts, of 39 different therapeutic classes. The most frequently involved therapeutic classes in those instances were antipsychotics (17.1%), antidepressants (15.2%), antiepileptic drugs (13.3%) and anxiolytic derived from benzodiazepines (12.0%). All together, these classes corresponded to 57.6% of the total registered (Table 1).

Household cleaning products were referred to in 3.4% (n=14) of the registered cases of suicide attempts, with disinfectants (bleach and ammonia) accounting for 8/14 of those cases and cleaning agents (muriatic acid, ethyl alcohol and caustic soda) in 6/14. Among the toxic agents

Table 1 – Distribution of suicide attempt cases (N=410) according to the toxic agent groups registered by the Toxicological Information and Assistance Center in Fortaleza, Ceará, 2013

Toxic agent groups	N	%
Pesticides	176	42.9
Agricultural Pesticides	124	70.4
Rodenticides	34	19.3
Pesticides of veterinary use	11	6.3
Pesticides for household use	7	4.0
Medicines (Anatomical Therapeutic Chemical Classification - ATC) ^a	162	39.5
Antipsychotics (N05A)	53	17.1
Antidepressants (N06A)	47	15.2
Antiepileptics drugs (N03A)	41	13.3
Anxiolytic derived from benzodiazepines (N05B)	37	12.0
Other analgesics and antipyretics (N02B)	26	8.4
Hypnotics and sedatives (N05C)	18	5.8
Antihistamines for systemic use (R06A)	14	4.5
Nonsteroidal anti-inflammatory/antirheumatic drugs (M01A)	9	2.9
Beta-adrenergic blocking agents (C07A)	8	2.6
Calcium channel blockers (C08C)	6	2.0
Thiazide diuretics (C03A)	6	2.0
Other classes	44	14.2
House cleaning products	14	3.4
Bleach	7	50.0
Muriatic acid	3	21.5
Caustic soda	2	14.3
Ammonia	1	7.1
Ethyl alcohol	1	7.1
Combinations	58	14.2
Agricultural pesticide + drug of abuse	15	25.9
Medicine + drug of abuse	13	22.4
Agricultural pesticide + medicine	7	12.1
Coumarin rodenticides + drug of abuse	4	6.9
Pesticides for household use + medicine	3	5.2
Coumarin rodenticides + medicine	3	5.2
Unknown pesticide + drug of abuse	3	5.2
Pesticides for household use + medicine	2	3.4
Medicine + house cleaning products	1	1.7
Unknown pesticide + medicine	1	1.7
House cleaning products + drug of abuse	1	1.7
Medicine + unknown pesticide + cosmetic	1	1.7
Unknown combinations	4	6.9

a) A single case may refer to the use of one or more medicines (N=309 agents)

in this group, bleach was the most frequently mentioned product in the records (Table 1).

From the cases of suicide attempt by simultaneous intake of different types of toxic agents (14.2%, n= 58), 12 combinations were identified and are described in Table 1. Pesticides (especially agricultural pesticides) were more frequently involved in these cases.

CEATOX/IJF treatment recording sheets presented some flaws in their content. When that occurred, the total number of sheets filled, referring to the different variables, was specified in Tables 2 and 3. The percentages presented in these tables refer to the total of record sheets filled.

In all toxic agent groups, most individuals were females (56.2%). As for age, most individuals were aged between 12 and 39 years old (79.7%), with an average age of 21 years. The lowest and highest ages were 12 and 84 years, respectively. The most frequently registered profession/occupation was student (19.7%). The most common municipality of residence was Fortaleza (67.2%). The cases were more frequent in urban areas (86.4%). As for the place of exposure to the toxic agent, home (94.9%) was the most prevalent in the records. The medication group was more prevalent for females (67.7%), age group between 12 and 29 years (62.9%), the municipality of Fortaleza (74.1%), urban areas (91.9%) and home (97.4%) (Table 2).

Out of the 410 cases of suicide attempts registered, all the individuals were orally exposed to the toxic agent.

With regard to clinical manifestations, 95.1% of the individuals presented signs and symptoms due to the exposure to the toxic agent and 59.7% of the individuals were hospitalized. As for the outcome of the individuals, 47% evolved to cure, 27.3% to non-confirmed cure, 4.1% to death, 0.3% to death by other causes, 0.3% to sequelae and 21% to other outcome (Table 3).

Out of the 16 deceased individuals, 10 were males. The average age was 26 years and the lowest and highest ages were 13 and 51 years, respectively. Agricultural pesticides were involved in 15 cases. The agricultural pesticides identified and referred to in the record sheets were "Chumbinho", which was solely responsible for 10 deaths, and dimethoate, an organophosphate insecticide, which was responsible for one death. "Chumbinho" and ethanol combined were responsible for one death. In three cases, the agents of the agricultural pesticides group were not identified. Only one toxic agent out of the medication group, non-identified, was responsible for one death (Table 4).

Discussion

The present study shows that the most frequently involved toxic agents in suicide attempts as registered by CEATOX/IJF were, firstly, pesticides, followed by medicines and house cleaning products. Most of the individuals were female and between the ages of 12 to 39 years old. The most frequently registered occupations/professions were, in the following order: student, housewife, unemployed, and farmer. Most of the individuals lived in urban areas and in the municipality of Fortaleza. All individuals were orally exposed to the toxic agents and the exposure occurred, mainly, at the individual's home. Most individuals showed signs and symptoms as a result of the exposure to the toxic agent. A large part of the cases presented cure as the outcome, followed by non-confirmed cure and death.

The findings of the present study corroborate with previous ones: pesticides and medicines were the most used toxic agents in suicide attempts.^{14,15} A study conducted in the Toxicological Information and Assistance Center of Santa Catarina, in the period from 1994 to 2006, showed that pesticides and rodenticides, closely followed by medicines, were the most prevalent toxic agents in the suicide attempts registered. The authors reported that, since 2002, the use of medication surpassed the use of pesticides and rodenticides and continued to increase until December 2006.¹⁶

One of the suppositions for the incidents caused by pesticides could be the access to those toxic agents. There are flaws in the control of the commercialization of pesticides, probably due to the violation of Law No. 7,802, dated July 11th, 1989.¹⁷ This law establishes the need of an agronomic prescription for the commercialization of those chemical products. This prescription would be the most adequate tool in the control of the commercialization and use of those products. However, studies have shown that pesticide commercialization usually happens without the requirement of a prescription. Frequently, this requirement is unknown, and therefore, unfulfilled.^{18,19}

The present study showed, besides the significant involvement of pesticides in suicide attempts, the high potential acute toxicity of those agents, especially agricultural pesticides, due to the lethality of those agents. Among agricultural pesticides, "Chumbinho" drew attention due to being involved in the highest percentage of the attempt cases that led to death. A similar result was found in a study that showed this product involved

Table 2 – Distribution of suicide attempt cases by toxic agent groups, according to sociodemographic characteristics, in the Toxicological Information and Assistance Center in Fortaleza, Ceará, 2013

Variables	Toxic agent groups									
	Pesticides		Medicines		House cleaning products		Combinations		Total	
	N	%	N	%	N	%	n	%	N	%
Sex (N=409)										
Male	91	51.7	52	32.3	6	42.9	30	51.7	179	43.8
Female	85	48.3	109	67.7	8	57.1	28	48.3	230	56.2
Age group (in years) (N=405)										
12-19	45	25.7	41	25.8	4	28.6	6	10.5	96	23.7
20-29	54	30.9	59	37.1	4	28.6	18	31.6	135	33.3
30-39	45	25.7	32	20.1	2	14.3	13	22.8	92	22.7
40-49	18	10.3	19	11.9	2	14.3	14	24.6	53	13.1
50-59	8	4.6	5	3.1	2	14.3	5	8.8	20	5.0
≥60	5	2.9	3	1.9	–	–	1	1.8	9	2.2
Profession/occupation (N=315)										
Student	19	14.4	35	27.6	2	25.0	6	12.5	62	19.7
Housewife	22	16.7	23	18.1	2	25.0	5	10.4	52	16.5
Unemployed	9	6.8	17	13.4	2	25.0	6	12.5	34	10.8
Farmer	17	12.9	1	0.8	–	–	5	10.4	23	7.3
Other	65	49.2	51	40.1	2	25.0	26	54.2	144	45.7
Municipality (N=409)										
Fortaleza	107	61.1	120	74.1	7	50.0	41	70.7	275	67.2
Caucaia		4.0	4	2.5	–	–	3	5.2	14	3.4
Maranguape	9	5.1	1	0.6	–	–	1	1.7	11	2.7
Maracanaú	3	1.7	4	2.5	1	7.1	2	3.4	10	2.4
Aquiraz	2	1.1	1	0.6	2	14.3	1	1.7	6	1.5
Morada Nova	5	2.9	1	0.6	–	–	–	–	6	1.5
Limoeiro do Norte	1	0.6	3	1.9	–	–	1	1.7	5	1.2
Paracuru	3	1.7	2	1.2	–	–	–	–	5	1.2
Eusébio	3	1.7	1	0.6	–	–	–	–	4	1.0
Guaiuba	1	0.6	2	1.2	–	–	1	1.7	4	1.0
São Gonçalo do Amarante	–	–	4	2.5	–	–	–	–	4	1.0
Other municipalities	34	19.5	19	11.7	4	28.6	8	13.8	65	15.9
Area (N=397)										
Urban	135	81.3	148	91.9	12	85.7	48	85.7	343	86.4
Rural	31	18.7	13	8.1	2	14.3	8	14.3	54	13.6
Place (N=391)										
Home	153	92.2	153	97.4	13	92.9	52	96.2	371	94.9
Outdoor environment	7	4.2	1	0.6	–	–	1	1.9	9	2.3
Workplace	3	1.8	–	–	–	–	–	–	3	0.8
Work route	1	0.6	1	0.6	–	–	–	–	2	0.5
School/daycare	1	0.6	1	0.6	–	–	–	–	2	0.5
Other	1	0.6	1	0.6	1	7.1	1	1.9	4	1.0

Table 3 – Distribution of suicide attempt cases by toxic agent groups, according to the variables of 'clinical manifestations', 'hospitalization' and 'outcome', in the Toxicological Information and Assistance Center in Fortaleza, Ceará, 20133

Variables	Toxic agent groups									
	Pesticides		Medicines		House cleaning products		Combinations		Total	
	N	%	N	%	N	%	n	%	N	%
Clinical manifestations (N=409)										
Yes	161	91.5	158	98.1	14	100.0	56	96.6	389	95.1
No	15	8.5	3	1.9	–	–	2	3.4	20	4.9
Hospitalization (N=392)										
Yes	116	67.4	77	50.7	7	53.8	34	61.8	234	59.7
No	56	32.6	75	49.3	6	46.2	21	38.2	158	40.3
Outcome (N=385)										
Cure	76	44.7	74	49.3	3	23.1	28	53.8	181	47.0
Non-confirmed cure	40	23.5	46	30.7	7	53.8	12	23.1	105	27.3
Death	14	8.2	1	0.7	–	–	1	1.9	16	4.1
Death by other cause	–	–	1	0.7	–	–	–	–	1	0.3
Sequelae	1	0.6	–	–	–	–	–	–	1	0.3
Other	39	22.9	28	18.7	3	23.1	11	21.1	81	21.0

in countless cases of acute human poisoning, many of those fatal, in the state of Rio de Janeiro.²⁰ "Chumbinho" is the popular name for aldicarb,²¹ a pesticide belonging to the class of carbamate insecticides, which had its commercialization banned in Brazil by the Ministry of Agriculture, Livestock and Supply in 2012.²² Nevertheless, this agent – as well as other carbamates – is available at illegal markets, which may explain its involvement in the suicide attempts registered by CEATOX/IJF in 2013. Most records at CEATOX/IJF refer to "Chumbinho"; few reported the term aldicarb, denoting, mainly, the use of the illegal product in those cases. It is imperative that the illegal commercialization of this pesticide is investigated, in order to curb this illegal activity.

In the medication group, the most frequently involved agents in the suicide attempts registered by CEATOX/IJF were psychotropics. In many cases, the use of more than one psychotropic drug was recorded. Other studies^{3,15} showed that among the many types of drugs, psychotropics were the most used in suicide attempts, in some cases two or more were combined,³ which confirms the findings of this research.

Some studies have found that mental disorders make individuals more likely to attempt suicide.^{23,24} Santos et al.²⁴ assessed the prevalence of mental

disorders in suicide attempts in a city hospital in Rio de Janeiro-RJ and observed that most of the individuals used psychoactive drugs regularly and had undergone psychiatric/psychological treatment before the attempt.

The highest percentage of suicide attempts by medication intake registered at CEATOX/IJF happened to females, between the ages of 12 and 29 years and at home. In this context, family conflict may justify the occurrence of suicide attempts in among teenagers their home,²⁵ although the present study did not investigate family relationships.

The control on the sale of medication through legal requirements may contribute to reduce suicide and suicide attempt rates. The limitation of the individual's access to lethal means is pointed out as an efficient intervention to prevent those episodes,¹¹ although it is not enough to prevent medicines from being one of the main groups of toxic agents involved in suicide attempts. Preventive interventions of medical and pharmaceutical assistance may help reduce the risks associated to the acquisition of medication. For instance, regarding psychotropics and the habit of stocking medicines at home, it is recommended that, at the moment of the medical appointment, guidance should be given on the proper disposal of medicines which are out of use

Table 4 – Distribution of deaths due to suicide attempts by exposure to toxic agents (n=16) according to sociodemographic characteristics and toxic agents in the Toxicological Information and Assistance Center in Fortaleza, Ceará, 2013

Variables	Sex		Total
	Female (N=6)	Male (N=10)	
Age group (in years)			
12-19	3	3	6
20-29	3	3	6
30-39	–	1	1
40-49	–	2	2
50-59	–	1	1
Municipality			
Fortaleza	4	6	10
Caucaia	–	1	1
Cariús	–	1	1
Morada Nova	–	1	1
Penedo	1	–	1
Quixadá	1	–	1
Unknown	–	1	1
Area			
Urban	6	9	15
Rural	–	1	1
Toxic agent groups			
Agricultural pesticides	5	9	14
Medication	1	–	1
Agricultural pesticide + drug of abuse	–	1	1
Toxic agent			
"Chumbinho"	5	5	10
Dimethoate	–	1	1
"Chumbinho" + ethanol	–	1	1
Unidentified agricultural pesticide	–	3	3
Unidentified medicine	1	–	1

or out of date,²⁶ as well as care and monitoring of the individuals under high risk of attempting suicide.^{9,10}

With regard to the individuals involved in the suicide attempts registered at CEATOX/IJF, there was a predominance of females and the largest percentage was between the ages of 12 and 39 years. Those findings are in accordance with the literature: suicide attempts, in many cases, are characterized as impulsive and low intentionality behavior, mostly observed in adolescent and young adult females,²⁷ with the easiest method available being the most widely used.²⁶ Men that commit suicide choose more violent methods than women, such as firearms and hanging.^{6,23} Findings show that

suicide attempts are more common among women, while suicide is more present among men,²⁸ which confirms the results of this study, in which women were more frequently involved than men in suicide attempts but mostly men sealed the act.

Regarding occupation/profession, student and housewife, unemployed and farmer, in this order, were most frequently mentioned in the record sheets for the suicide attempts that were analyzed. A similar result was found in another research.²⁸

Most of the individuals assisted lived in the Metropolitan Region of Fortaleza, which can be partly explained by the location of the CEATOX/IJF. That is the only specialized

center for the care of individuals exposed to toxic agents and/or poisoned individuals in the state of Ceará.

A problem identified by this study was that CEATOX/IJF does not register the instances of phone service, whether to health specialists in other units or to the general public. Hence, the total number of cases of human exposure to different types of toxic agents (3,707) registered by CEATOX/IJF in 2013 referred only to face-to-face medical care. In this case, there was undernotification of the data regarding the care of toxic events carried out by CEATOX/IJF. The inadequate, frequently incomplete, filling of the record sheets used for registering these events also drew attention.

Despite the flaws mentioned previously, what is more important is the great contribution given to CEATOX/IJF along with the other Toxicological Information and Assistance Centers, which provide visibility to poisonings, currently considered an important issue in Public Health. Only after the Ministerial Act GM/MS No. 2,472 dated August 31st 2010,²⁹ poisonings were included as health problems of compulsory notification. Until

then, only occupational poisonings were of compulsory notification, as established by Ministerial Act GM/MS No. 777 dated April 28th 2004.³⁰

Given the above stated, it is necessary to improve data collecting on the treatment of individuals exposed to toxic agents and/or poisoned individuals, which may be achieved through continuous education of the professionals at the Toxicological Information and Assistance Center in Fortaleza. Improving the availability and quality of data derived from hospital record sources and systems is necessary for effectively preventing these occurrences,² besides providing reliability to studies that use this type data.

Authors' Contributions

All the authors contributed to the planning and design of this study, with the analysis and interpretation of the results, writing and critical revision of the manuscript's intellectual content and declared to be responsible for all aspects of this study, ensuring its accuracy and integrity.

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