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Epidemiological profile of exogenous intoxication cases reported in the state of Amazonas, Brazil, between 2013 and 2022

Perfil epidemiológico das intoxicações exógenas notificadas no estado do Amazonas - Brasil entre 2013 a 2022

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ABSTRACT
To evaluate the epidemiological profile of exogenous intoxications reported in the state of Amazonas between 2013 and 2022. This was an epidemiological, cross-sectional, retrospective, and descriptive study using public data made available by the Ministry of Health from 2013 to 2022. The analysis found 9,788 cases of intoxication; 2019 was the year with the highest number of cases. The individuals were predominantly male (61.4%), aged between 20 and 39 (49.4%), and brown (56.8%). Drugs of abuse were the main causes of intoxication, accounting for 3,330 cases (34.0%). Abuse stood out in the circumstances of intoxication (29.0%), with single-acute exposure (46.0%), clinical confirmation (68.7%), and evolution without sequelae (68.7%). The prevalence of intoxication by drugs of abuse, especially in men with low education, indicates the need to more efficiently target public health policies and educational strategies for these groups.

Keywords: Epidemiological Profile. Intoxications. Morbidity. Risk to Human Health. Public Health

RESUMO
Avaliar o perfil epidemiológico das intoxicações exógenas notificadas no Amazonas entre 2013 e 2022. Trata-se de um estudo epidemiológico, transversal, retrospectivo e descritivo utilizando dados públicos disponibilizados pelo Ministério da Saúde dos anos de 2013 a 2022. Foram encontrados 9.788 casos de intoxicações, sendo o ano de 2019 com o maior número de casos. Os indivíduos eram de predominância masculina (61,4%), tinham entre 20 a 39 anos (49,4%) e raça parda (56,8%). As drogas de abuso foram as principais causas de intoxicação com 3.330 casos (34,0%). O abuso se destacou nas circunstâncias de intoxicação (29,0%), com tipo de exposição aguda-única (46,0%), critério de confirmação clínico (68,7%) e com evolução de cura sem sequelas (68,7%). A prevalência de intoxicações por drogas de abuso, principalmente em homens com baixa escolaridade, indica a necessidade de direcionar de forma mais eficiente as políticas de saúde pública e estratégias educacionais para esses grupos.

Palavras-chave: Perfil Epidemiológico. Intoxicações. Morbidade. Risco à Saúde Humana. Saúde Pública.

INTRODUCTION

Exogenous intoxication is a pathological process with the expression of signs and symptoms resulting from exposure to substances that cause a homeostatic imbalance in the human organism[1,2]. These substances can be found in nature, such as in air, animals, water, and foods that have some level of contamination, or in isolation, such as in medicines, cleaning products for industrial use, and even those for everyday use[3].

The effects from exposure to these elements may vary according to the type of substance, quantity, frequency, and exposure time[1]. The clinical condition of the exposed individual may include pulmonary, gastrointestinal, cardiovascular, and renal complications. If not treated immediately, these conditions can worsen[4].

Given the importance of exogenous intoxication, at a global level, the World Health Organization (WHO) estimates that around 1.5 to 3.0% of the world population is intoxicated annually[5]. The WHO also highlights that each year, approximately 1 million people die as a result of poisoning by chemical agents[6].

In Iran, a study carried out in a specialized medical center on intoxication from household products between 2015 and 2016 found 5,946 cases. Intoxications were higher among men (57.8%), with an average age of 34.4 years. Accidental intoxication (63.9%) was the most common type of exposure. The most common household products were sodium hypochlorite (32.5%). Most intoxications occurred at home (59.0%)[7].

In Egypt, a study on the profile of intoxications with data from 2017 to 2021 found 9,713 cases. Rodenticides were the most common cause of intoxication among males (30.0%), while in the opposite sex, this percentage was 27.0%. Intentional intoxication (58.6%) was more prevalent than accidental intoxication (34.7%). The death percentage was 4%. Mortality from rodenticide poisoning was 12.5%[8].

In Brazil, according to data from the National Toxic-Pharmacological Information System (SINITOX), in 2017, 24,488 cases of human poisoning by toxic agents related to medicines, pesticides, and food were recorded, highlighting the circumstances of the cases as attempts to suicides with 10,935 cases (44.7%) and individual accidents with 6,567 cases (26.8%)[9].

Studies indicate that intoxication has important impacts on the health system. In the study carried out in Belo Horizonte, state of Minas Gerais, with (n= 353) individuals who suffered accidental poisoning, around 15.0% remained hospitalized for up to two days[10], with the average daily cost of hospitalization for an adult being approximately R$ 207.08[11].

In addition, a study in the southern region of Brazil, through the collection of data from 2007 to 2015 on problems caused by exogenous poisoning, found 158 cases of metal poisoning, in which the year 2007 had the highest number of confirmed cases. The metals most involved in these cases were mercury (41.0%) and lead (40.2%)[12]. Furthermore, according to a study carried out in the same region from 2013 to 2017, 18,544 cases of self-inflicted violence were recorded. The most commonly used method was poisoning/intoxication, which represented 39.7% of cases[2].

In addition, poisoning from medication abuse is also identified as an important public health problem, with a high prevalence (29.7%) over 10 years in the Brazilian Northeast[13]. In the state of Bahia over 11 years, medications were the main toxic agent in cases of intoxication, with a predominance of females (55.2%) in the age group between 20 and 39 years (41.7%), involving a high prevalence of suicide attempts (30.6%)[14]. Furthermore, a study in the central-western region of Brazil between 2008 and 2013 on exogenous intoxication among children and adolescents revealed a high rate of drug

intoxication, especially in children aged 0 to 4 years, which represented 43.4% of the total[15].

Another aspect evidenced by studies relates the age range of the cases to the events that result in human intoxication by exogenous elements. According to research carried out in Arapiraca, state of Alagoas, with data from 2007 to 2015, there were records of 5,539 cases of exogenous intoxication among children and adolescents aged 0 to 19 years. Moreover, the study in question showed the highest rates of cases among children aged 0 to 4 years, totaling 2,419 cases (43.7%)[1].

Given the above, cases of exogenous intoxication in the context of different health regions in Brazil can be aggravated depending on access to health services and the type of toxic agent involved[10]. Concerning the Amazon region, these aspects become even more evident, especially because of difficulties in accessing riverside communities, seasonal events (river floods and droughts), and socioeconomic aspects of the population, which implies difficulty for these individuals to reach health centers in the region[16].

In this sense, detailed knowledge of the epidemiological characteristics of these intoxications is crucial, both for the scientific community and for the population, as it can guide the implementation of effective intervention and prevention measures through health actions aimed at raising awareness of the population about health problems related to this condition, and how the community can actively participate in the control and eradication of cases caused by toxic agents.

Although exogenous intoxication represents a public health problem, studies investigating their impacts in the state of Amazonas are still incipient. Therefore, this study aimed to evaluate the epidemiological profile of exogenous intoxication cases reported in Amazonas between 2013 and 2022.

METHODOLOGY

This was an epidemiological, cross-sectional, retrospective, descriptive study, about the epidemiological profile of exogenous intoxications in the state of Amazonas. The research used data from the Information Technology Department of the Unified Health System (DATASUS), which provides public data on notifications of health problems. This study examined disease notifications available on the website, focusing on exogenous intoxication. The manuscript was written according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

The study population was made up of reported cases of exogenous intoxication in the state of Amazonas, available on the DATASUS platform. According to the last census of 2022, the population of Amazonas was 3,941,613 people. The demographic density in the Amazonian territory, which is only 2.53 inhabitants per square kilometer, reflects the Amazonian context, characterized by being sparsely populated. The population of Amazonas is distributed across 62 municipalities, most of which are small. However, the largest population concentration is found in the capital, Manaus, which is home to 52.3% of the state's population, according to data from the 2022 Census[17]. The demographic density of Manaus is extremely discrepant from the other municipalities in the state, with 158.06 inhabitants per square kilometer. This population concentration is related to the geographic distance between the municipalities, distributed in a state mostly covered by the Amazon Forest, representing more than 90% of the territory[17].

Data were collected in September 2023 by consulting the Portal of the Information Technology Department of the Unified Health System (DATASUS) (https://datasus.saude.gov.br/informacoes-de-saude-tabnet/), with the selection of the options Notifiable Diseases and Conditions - 2007 onwards (SINAN), exogenous intoxication,

with the geographic scope being the State of Amazonas, with subsequent selection of rows and columns with the variables of interest, according to the study period.

This research used the total population and did not use a sample and sampling process. Therefore, all cases of exogenous intoxication in the state of Amazonas reported in DATASUS between 2013 and 2022 were included in this study. This was the only inclusion criterion.

The variables addressed were related to the year of notification (2013 to 2021), the total number of confirmed cases, cases per year, age group (< 1, 1 to 4, 5 to 9, 10 to 14, 15 to 19, 20 to 39, 40 to 59, 60 to 64, 65 to 69, 70 to 79, 80 or more), education (illiterate, complete/ incomplete primary education, incomplete high school or over), sex (female and male) race (white, black, brown, yellow, indigenous), and toxic agent (medicine, agricultural pesticide, domestic pesticide, public health pesticide, rodenticide, veterinary product, household product, cosmetics, chemical product, metal, drugs of abuse, toxic plant, food and drink, other).

We also analyzed the variables related to the circumstance of intoxication (habitual, accidental, environmental use, therapeutic use, medical prescription, administration error, self-medication, abuse, food intake, suicide attempt, attempted abortion, violence/homicide, other), type of exposure (single-acute, repeated-acute, chronic, acute-on-chronic), confirmation criteria (clinical-laboratory, clinical-epidemiological, clinical) and evolution (cure without sequelae, cure with sequelae, death due to exogenous intoxication, death from another cause, loss of follow-up).

For data analysis, simple statistics were applied using Microsoft Office Excel (2016) software to calculate absolute and relative frequency. There was a need to adjust only the frequency interval of the education variable; the others were presented as found on the DATASUS platform. The results were presented descriptively, using graphs and tables.

As this was a study using secondary data, without identifying the participants, obtained from a public database, submission to the Research Ethics Committee was waived under the terms of Resolution 510 of April 7, 2016, and Article 1, items II and III of Ordinance 466/2012 of the National Health Council, which provides for research that will not be registered or evaluated by the Research Ethics Committee.

RESULTS

Exogenous intoxications represented 9,788 cases reported in the state of Amazonas from 2013 to 2022, with an annual average of approximately 979 cases. The year 2019 presented the highest number of notifications (1,680), and the year 2014 had a lower frequency considering the study period (492) (Figure 1).

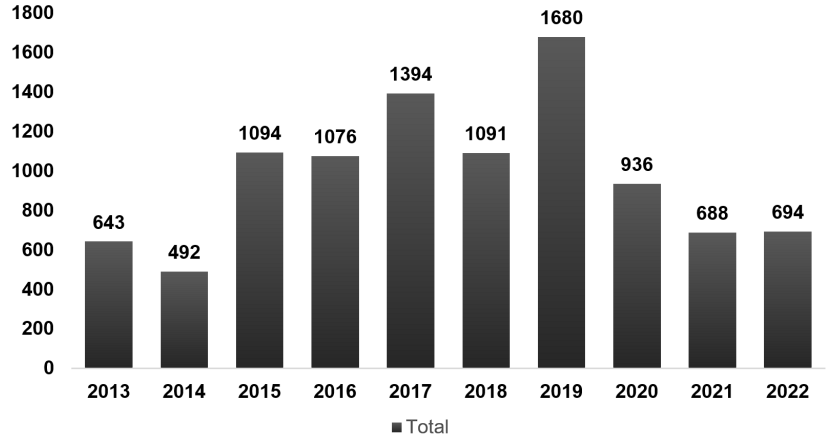

Figure 1. Distribution of reported and confirmed cases of intoxication in the state of Amazonas from 2013 to 2022.
Source: SINAN/DATASUS (2023)

The analysis of the sociodemographic profile showed a higher frequency among males (61.4%), aged between 20 and 39 years (49.4%), and brown (56.8%) (Table 1).

Table 1. Distribution of sociodemographic characteristics of reported cases of exogenous intoxication in the state of Amazonas between 2013 and 2022, Manaus, state of Amazonas, 2023.

(Continued)

Variables	Frequency	
	n= 9788	%
Gender		
Male	6,008	61.4
Female	3,779	38.6
Ignored	1	0.0
Age range, in years		
<1	193	2.0
1-4	893	9.1
5-9	206	2.1
10-14	360	3.7
15-19	1,374	14.0
20-39	4,834	49.4
40-59	1,640	16.7
60-64	125	1.3
65-69	68	0.7
70-79	68	0.7
≥80	27	0.3
Race/skin color		
Brown	5,566	56.8
White	422	4.3
Indigenous	90	1.0
Black	85	0.8
Yellow	11	0.1
Ignored	3,614	37.0
Education		
Illiterate	71	0.7
Complete/incomplete primary education	1,053	10.8
Incomplete high school or over	893	9.1
Ignored/blank	6,576	67.2
Not applicable	1,195	12.2

(Conclusion)

Source: SINAN/DATASUS (2023)

The main toxic agents involved were drugs of abuse (34.0%), food and beverages (20.2%), and medicines (15.3%) (Table 2).

Table 2. Distribution of reports of exogenous intoxication according to the toxic agent. Manaus, state of Amazonas, 2023.

Variables	Frequency	
	n= 9,788	%
Toxic agent		
Drugs of abuse	3,330	34.0
Food and beverage	1,983	20.2
Medicine	1,503	15.3
Product for home use	463	4.7
Other	335	3.4
Chemical product	277	3.0
Rodenticide	237	2.4
Agricultural pesticide	165	1.7
Household pesticide	154	1.5
Cosmetics	68	0.7
Veterinary product	40	0.4
Public health pesticide	28	0.3
Toxic plant	35	0.3
Metal	15	0.1
Ignored/blank	1,155	12.0

Source: SINAN/DATASUS (2023)

The main circumstances of intoxication were abuse (29.0%) and accidental (15.2%), with single-acute exposure (46.0%), with the main confirmation criterion being the clinical status (50.2%). Most cases evolved without sequelae (68.7%) (Table 3).

Table 3. Distribution of notifications of exogenous intoxication according to the circumstances of intoxication, type of exposure, confirmation criteria, and evolution. Manaus, state of Amazonas, 2023.

(Continued)

Variables	Frequency	
	n= 9,788	%
Circumstance of intoxication		
Abuse	2,835	29.0
Usual use	1420	14.5
Accidental	1494	15.2
Suicide attempt	834	8.5
Food intake	901	9.2
Self-medication	340	3.4
Other	128	1.3
Violence/homicide	27	0.3
Environmental	82	1.0
Therapeutic use	88	1.0
Administration error	102	1.0
Attempted abortion	12	0.1
Medical prescription	05	0.0
Ignored/blank	1,520	15.5
Type of exposure		
Single-acute	4,503	46.0
Repeated-acute	1,444	14.8
Acute-on-chronic	81	0.8
Chronic	500	5.1
Ignored/blank	3,260	33.3
Confirmation criteria		
Clinical	4,912	50.2
Clinical – epidemiological	3,733	38.1
Clinical-laboratory	488	5.0
Ignored/blank	655	6.7
Evolution		
Cure without sequelae	6,722	68.7
Death from exogenous intoxication	69	0.7
Loss of follow-up	54	0.5
Cure with sequelae	113	1.2
Death from another cause	18	0.2
Ignored/blank	2,812	28.7

Source: SINAN/DATASUS (2023)

DISCUSSION

Our results showed that exogenous intoxication constitutes an important public health problem in the state of Amazonas due

to the high number of reports of exogenous intoxication in 2019.

Exogenous intoxications, considered compulsory notification, are pathological manifestations arising from the interaction between the biological system and toxic substances or supra-therapeutic doses. They can occur either through ingestion of toxic agents or through direct contact with the skin, eyes, or mucous membranes[18].

In Brazil, notifications of exogenous intoxication are carried out through the Notifiable Diseases Information System (SINAN), one of the six health information systems (SIS), through individual disease investigation and notification form[14,19].

The high number of notifications of this condition in 2019 may be a result of the improvement in the compulsory notification system in the state of Amazonas. The transfer of specific federal resources to all states, intended for health surveillance actions for notifiable diseases, has possibly boosted the number of these records[20]. However, this number could be even higher, given the data gaps still found in cases of exogenous intoxication in Amazonas[19].

Exogenous intoxication can vary between men and women, race, and education. The gender of intoxication victims is an important risk factor for this condition. In this study, a higher number of intoxication cases was identified in males, which contrasts with data found in the same Amazonian context; in the state of Pará between 2012 and 2021, there was a predominance of exogenous intoxication in females[21]. This demonstrates that exogenous intoxication varies among Amazonian populations. In Amazonas, the higher number of intoxication cases among men may be explained by the tendency of men to abuse drugs more than women. Furthermore, early addiction to narcotics among Amazonian youth may contribute to this scenario[22,23].

The predominance of cases in brown individuals may be related to the demographic composition of Amazonas, where the majority of the population is made up of non-white individuals. This particularity may be a reflection of the sociocultural formation of the Amazon, a region marked by miscegenation between indigenous-caboclo, black, and white cultures[9,19,22,24,25].

The research revealed that individuals with low education had higher numbers of intoxication cases. A previous study shows low education as a socioeconomic vulnerability factor for intoxication[26]. The socioeconomic situation in Amazonas is characterized by high levels of vulnerability, with worrying indicators of poverty, hunger, and social inequality. Furthermore, the region has low social prosperity and per capita income. Informality and dependence on income transfer programs are other challenges faced by the local population. This complex situation was further aggravated by the emergence of the COVID-19 pandemic[27]. These contexts may have significantly contributed to the higher likelihood of drug abuse and increased the occurrence of exogenous intoxications in the state[14].

Most cases of intoxication in Amazonas were caused by drugs of abuse. Drugs of abuse are substances capable of altering the functioning of the Central Nervous System (CNS), including alcohol, tobacco, marijuana, cocaine, crack, and solvents[24]. These are considered a severe public health problem, which involves a complex social context, including chemical dependency, attempted suicide, violence, and drug trafficking[28].

In a previous study, a significant increase in the number of notifications of cases of intoxication by drugs of abuse in the state of Amazonas was identified, reaching a rate of 18.4 per 100 thousand inhabitants in 2019, in which the digestive and respiratory tracts were the most prevalent in cases of intoxication[24]. Therefore, there may be flaws in education, public security, social assistance, and economic and health policies in Amazonas. These failures may have contributed to the increase in cases of

intoxication due to drugs of abuse.

The present study revealed an alarming number of exogenous food and drink intoxication. Food intoxication and outbreaks of Waterborne Diseases appear to reflect a national trend. In 2019, this type of intoxication was classified as the third biggest cause of intoxication in Brazil[29]. According to Batista et al. (2022), the increase in the incidence of food intoxication may be associated with the crowding of people in urban areas and changes in eating habits, particularly the consumption of contaminated food in bars, restaurants, and the like. In the Amazon context, unsatisfactory sanitation conditions, especially in rural areas where unsuitable water collected in rivers and lakes is consumed, can contribute to cases of exogenous intoxication resulting from water-borne diseases[16].

Another important finding in this study was the cases of medication intoxication. In the context of toxic substances, medications are the most involved in intoxication. In 2016, they represented 34.0% of intoxication cases in Brazil[30]. This scenario is particularly worrying in the Amazonian context, where there is evidence of a high prevalence of self-medication. The habit of stocking medicines at home for empirical use is common among the population, especially in riverside areas where it is difficult to access emergency services in case of intoxication[16].

The majority of reported intoxication cases were confirmed based on the patient's clinical assessment. In this context, a physical examination, together with a detailed survey of the clinical history of intoxication victims, emerges as crucial elements to provide correct management and humane treatment[30]. These actions are essential for the proper performance of emergency medical services, contributing to the reduction of deaths and sequelae of intoxication victims.

Considering the practical implications of the present study, knowledge of the profile of exogenous intoxications in the state of Amazonas will enable the basis of public actions and policies to outline intervention and prevention measures for these diseases. The data revealed that certain demographic groups are more vulnerable to exogenous intoxication. This information is crucial for targeting specific policies and programs for these groups. Furthermore, the study highlights areas where social assistance and health services can be improved. This is particularly relevant for combating and preventing the consumption of drugs of abuse.

As for the limitations of the study, they are related to the use of secondary data from toxicological occurrence notification forms from health services in Amazonas. Importantly, these data may be underreported or incomplete, as observed in some variables. Underreporting may affect the interpretation of results, as it may suggest that exogenous intoxication cases are less prevalent than they are. This can lead to an inadequate allocation of resources for the control and prevention of intoxication.

To mitigate these limitations in future studies, efforts must be made to increase the reporting of intoxication cases through awareness campaigns and training of health professionals or include the use of digital technologies for data collection and the implementation of rigorous protocols to ensure data quality and completeness. Nevertheless, this approach has advantages, as it allows broad knowledge about the general characteristics of exogenous intoxication in different regions of Brazil.

CONCLUSION

This study provided a comprehensive analysis of exogenous intoxication reported in the state of Amazonas between 2013 and 2022. The results highlight the importance of targeted preventive and intervention measures, considering the specific epidemiological characteristics of these cases in the region. The

predominance of intoxication by drugs of abuse in men and circumstances such as low education point to specific areas where public health policies and education strategies can be more effectively targeted. Studies should continue to monitor this public health problem to mitigate its impact on the population of Amazonas. Our findings are expected to inform and guide future research and prevention initiatives in the state.

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