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Intoxications by pesticides in the State of Tocantins: 2010-2014

Intoxicações por agrotóxicos no estado do Tocantins: 2010-2014

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ABSTRACT

Introduction: Brazil is the world's largest consumer of agricultural pesticides. That represents a serious public health problem caused by the population and environment exposure to those products. **Purpose:** To identify intoxications by agricultural pesticides in Tocantins during the years 2010-2014. **Method:** descriptive and exploratory study, having as a secondary data source the Notifiable Disease Information System (SINAN), making use of selected variables. **Results:** In the total, women are shown as the most affected by exogenous intoxications and men by agriculture pesticides, mainly the general farmer workers. The age groups most affected by agriculture pesticides are 20-29 years and 30-39 years. The most commonly reported toxic agents were insecticides (29.28%) and herbicides (27.07%). The most frequent activities were spraying (29.28%) and dilution (15.47%) and the main routes of exposure/contamination were the digestive and respiratory ones. In terms of exposure/contamination the accidental (49.17%), suicide attempt (32.60%) and environmental (14.64%) were the most present ones. **Conclusions:** The data reveal a serious picture that requires attention from the managers in facing that public health problem. This scenario represents a great and challenging issue for Brazil, the public health system – SUS, especially concerning health care, sanitary and epidemiological surveillance and environmental and worker health.

KEYWORDS: Agriculture Pesticides; Notifiable Disease Information System (SINAN); Health Surveillance; Poison

RESUMO

Introdução: O Brasil é o maior consumidor mundial de agrotóxicos, que é um sério problema de saúde pública pela exposição da população e do ambiente a estes produtos. **Objetivo:** Caracterizar as intoxicações por agrotóxicos no Tocantins no período 2010-2014. **Método:** Estudo descritivo e exploratório, tendo como fonte de dados secundários o Sistema de Informação de Agravos de Notificação (SINAN), utilizando-se variáveis selecionadas. **Resultados:** No total das intoxicações exógenas, o sexo feminino é o mais afetado e nas intoxicações, já por agrotóxicos, é o masculino, principalmente a categoria ocupacional dos "trabalhadores da agropecuária diversos". As faixas etárias mais atingidas por agrotóxico de uso agrícola são: 20-29 anos e 30-39 anos. Os agentes tóxicos mais referidos foram os inseticidas (29,28%) e os herbicidas (27,07%). As atividades mais frequentes foram a pulverização (29,28%) e a diluição (15,47%); e as principais vias de exposição/contaminação foram a digestiva e a respiratória. Quanto à exposição/contaminação, as mais presentes foram a acidental (49,17%), a tentativa de suicídio (32,60%) e a ambiental (14,64%). **Conclusões:** Os dados revelam uma situação preocupante que demanda atenção dos gestores no enfrentamento deste problema de saúde pública. Esse cenário é desafiador especialmente no componente assistencial, nas vigilâncias sanitárias, epidemiológica e em saúde ambiental e do trabalhador.

PALAVRAS-CHAVE: Agrotóxico; SINAN; Vigilância em Saúde; Veneno

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INTRODUCTION

In 2008, Brazil became the largest consumer of pesticides in the world. The impacts of intensive use of pesticides on public health are high. They comprise large territories and different population groups, like workers from various fields of activity, people living near factories and farms, and the entire population that consumes contaminated food[1,2].

The official information systems, responsible for reporting poisoning episodes, do not satisfactorily meet the objectives of the surveillance system. In practice, only the most severe cases are recorded[3].

In recent years, there has been an increase in notifications of pesticide poisoning cases in the state of Tocantins, Brazil, according to the Brazilian Notifiable Disease Information System (SINAN) database, which may indicate an increase in poisoning cases or reports, or both. We found no specific studies about this issue in Tocantins, but we highlight: a) the increasing amount of agricultural pesticides used in the state. In 2012, the amount of pesticides sold per cultivated area was estimated to be 4.8 kg/ha; in 2013, 5.7 kg/ha and, in 2014, 5.9 kg/ha[4]; b) the size of the rural population in Tocantins: about 73,000 families[5]; c) the possibility of high underreporting of poisoning cases in Tocantins, considering that in Brazil the records refer basically to acute poisonings[6]; d) the high number of illness reports of workers and other people in different states, which can also occur in Tocantins[1,6,7]; e) probably, health professionals in Tocantins, like anywhere else, find it hard to associate the clinical condition of a patient with pesticide poisoning, especially in chronic cases[6].

Pesticides are the subject of various strategies to increase their consumption and, moreover, are involved in intense conflicts of interest between health and market segments.

In Brazil, products classified as animal health-related – hygiene, animal care and management and those used in veterinary medicine, like antibiotics and vaccines - and crop protection products are regulated by the Ministry of Agriculture, Livestock and Supply; however, in the case of pesticides, according to Law n. 7.802, of July 11, 1989, there is a distribution of regulatory competencies among the Ministries of Health, Agriculture and Environment. That is, there is a complementary relationship among these ministries regarding the functions, guidelines and requirements to be followed about human health, agriculture, livestock and the environment. In order to register a product in one sector, it is essential that the other party agree with the specific requirements[8].

The Brazilian model of agricultural modernization puts the current agricultural regions in a situation of great vulnerability under the so-called globalizing modernization. According to Milton Santos[9], the modernized countryside is more accessible to the expansion of the present forms of capitalism than the municipalities. While urban areas emerge as places of resistance, farmland become the space of vulnerability.

This process has enabled the implantation of some sectorial projects in different territories in Brazil and led to the intensive use of natural goods, thus reproducing regional and social inaqualities[10]. This situation leads to the use of great amounts of pesticides in the regions where the so-called agribusiness prevails, mainly in the places where there is much soybean and sugarcane, the latter being important for the production of ethanol[11].

In relation to the environment, pesticides, due to their contamination potential, became one of the most relevant problems for environmental conservation. Even if they have been developed to act on a set of organisms, these substances are potentially harmful to all living organisms exposed to them[12].

One of the main manifestations about the health sector concern with the effects of pesticides on public health was the publication, in 2015, of a document called “Positioning of the Brazilian Cancer Institute José Alencar Gomes Silva (INCA) on Pesticides”. The purpose of the document, according to the INCA, is to express the position of the institute against the current pesticide practices in Brazil and highlight the health risks, especially in the cases of cancer[13].

Considering the relevance of this problem, this study aimed to characterize the situation of pesticide poisoning in Tocantins, from 2010 to 2014, according to SINAN notifications.

METHOD

This descriptive and exploratory study was based on SINAN data on exogenous poisoning reports occurred from 2010 to 2014. Data were analyzed according to a set of variables of interest. The unit of geographical analysis and scale was the municipality, with a regional focus. Tocantins has 139 municipalities and eight Health Regions.

For this study, we performed a survey and tabulated official data from SINAN, from the Brazilian Institute of Geography and Statistics (IBGE) and from the Brazilian Union of Plant Protection Product Industries (Sindiveg). In the first stage of the data collection, from the SINAN database, we identified all the reports of exogenous poisoning in Tocantins from 2010 to 2014. They were then organized into Excel 2010 spreadsheets, according to predetermined variables.

We defined the following variables and fields of interest: i) general and residence data (year, notification and residence municipality); ii) individual information (age group and gender); iii) epidemiological background (profession/occupation); iv) Exposure data (exposure zone, toxic agent group, active ingredient, purpose, activity, agricultural/farming culture, exposure/contamination type, route, circumstance and relation to the job/occupation; v) hospital care and conclusion of the case (attendance, final grading, confirmation criterion and evolution of the case).

Table 1. Distribution of the reported cases of exogenous poisoning by gender and type of poisoning according to the toxic agent in Tocantins, from 2010 to 2014.

Types of poisoning	Male		Female		Total	%
	No.	%	No.	%		
All exogenous poisonings	2,510	46.16	2,927	53.84	5,437	100.00
Poisoning by other toxic agents	2,078	43.86	2,660	56.14	4,738	87.15
Poisoning by all pesticides (agricultural, public health and domestic)	432	61.80	267	38.20	699	12.85
Poisoning only by agricultural pesticide (all variables)	327	70.93	134	29.07	461	8.47
Poisoning by agricultural pesticide only according to the selected variables	**250**	**69.06**	**112**	**30.94**	**362**	**6.66**
Poisoning by public health pesticides according to the selected variables	20	44.45	25	55.55	45	0.82
Domestic pesticides according to the selected variables	85	44.05	108	55.95	193	3.55

Source: SINAN/Tocantins.

Table 2. Municipalities with poisoning notifications by agricultural pesticides in Tocantins from 2010 to 2014 (N = 362).

Order	Municipality	N. of notifications	%
1	Araguaína	149	46.16
2	Palmas	35	9.67
3	Colinas	29	8.01
4	Porto Nacional	20	5.52
5	Lagoa da Confusão	16	4.42
6	Gurupi	13	3.59
7	Paraíso do Tocantins	12	3.31
8	Guaraí	11	3.04
9	Dianópolis	10	2.76
10	Miracema	9	2.50
11	Others (21)	58	16.02
Total	**362**		**100**

Source: SINAN/Tocantins.

To access the SINAN database, we requested and obtained permission from the Tocantins Health Department.

RESULTS AND DISCUSSION

According to Table 1, from 2010 to 2014 there were 5,437 poisoning reports by all toxic agents. Females were affected more often. Poisoning cases for the three types of pesticides - for agricultural, public health and domestic use - add up to 699 occurrences or 12.85% of the total exogenous poisoning cases, with a higher proportion in males. Among the poisoning cases, the distribution percentages, according to the types of pesticides, were: agricultural, 6.66%; public health, 0.82% and domestic use, 3.55%. In the first case, there was a strong predominance in males; in the others, the female gender prevailed.

Gender issues related to the exposure to these products are relevant in epidemiological terms and in relation to agricultural pesticides, object of this study. Official data of demographic census and academic studies, like those cited above, among others, point to a greater exposure of males; this deserves attention in order to understand the health situation of the populations, since the social and demographic characteristics are heterogeneous in the Brazilian rural environments[14,22,23].

The results of the study on the total number of municipalities that reported pesticide poisoning in their health units indicate 31 notifying municipalities, or 22% of the 139 municipalities in Tocantins (Table 2). The top ten notifying municipalities account for 84% of the notifications, while the others account for very low percentages, between 0.28% and 2.21% of notifications during the analyzed period.

Araguaína, a municipality located in the Middle North Araguaia Health Region, is the main city with notifications of agricultural pesticide poisonings in Tocantins, as it accounts for 41.16% of the total. This situation may be related not only to the fact that it has the state's 2nd largest population, but also because it has a better healthcare network compared to other municipalities, except Palmas, which makes it a reference in several health problems to a number of Tocantins municipalities and also to the neighboring states of Pará, Maranhão and Piauí, among others. The small poisoning notification percentages in a large number of municipalities may be related to their public health network infrastructure, where services are limited. This situation leads to the displacement of users of the public health system care services to other municipalities.

In the case of residence municipalities with poisoning notifications by agricultural pesticides, the main notifying municipality is also Araguaína, which accounts for more than 25% of the notifications. The ten residence municipalities with most notifications reached 59.10% of the total. We also found that, of the 139 Tocantins municipalities, there are records of this type of poisoning notification in 77, i.e., 55.39% of the total. In quantitative terms, 62 municipalities still did not register cases of agricultural pesticide poisoning. As mentioned, these numbers may not reflect the reality of a state with

agricultural characteristics in view of the steady increase in the use of these products.

Regarding the distribution of poisoning episodes by agricultural pesticides by gender and age group (Table 3), the results show that males presented the highest percentage of reported cases (69.06%), possibly due to the fact that men work more in activities that are more exposed to pesticides than women. The highest proportion of poisoning occurred in the age groups of 20-29 years (25.14%) and 30-39 years (18.78%), accounting for about 44% of all poisoning cases. This is related to the fact that the majority of the workforce is precisely in these age groups, whether in urban or rural areas, which means greater contact and exposure to pesticides, correlatively to the other age groups. The percentage of notifications found in the age groups of 1-9 years (11.9%) and 10-19 years (13.3%) is noteworthy, which may also indicate the involvement of these groups with the activities that use these poisons. Studies showed that women are more exposed to the effects of pesticides throughout their lives and that they did not realize the severity of the health problems related to exposure to these chemicals, nor did they identify the work activities they performed as hazardous[15,16].

Female exposure to the effects of pesticides, especially in rural areas, is characterized by the participation of the whole family, or most of it. In this case, productive activities are related to family farming, in which women and even children are included in the labor activities[17], as the percentages of notifications in the age groups that cover this population group indicate.

Regarding the distribution of reported cases of pesticide poisoning according to the occupation (Table 3), the category of "diverse agricultural workers" reaches more than 26%, with a predominance of males. Another fact that stands out is the percentage of poisoning cases related to housewives and students: 5.54% and 9.43%, respectively. This finding may indicate the involvement of these population groups in agricultural activities that use pesticides. We highlight that the largest percentage of occupation (about 50%) is in the "empty" field, that is, in 50% of the notifications cases there is no information about it, which limits the possibilities of analysis in this item[18,24].

Concerning the purpose of the toxic agents (Table 4), the most frequent were insecticides (29.28%) and herbicides (27.07%). Among the activities performed with case records, the most frequent were spraying (29.28%) and dilution (15.47%).

We found that some of the toxic agents that caused poisoning are prohibited or banned in Brazil, such as the one colloquially known in Brazil as *chumbinho* (Temik - Aldicarb and Aldrin - an organochlorine).

The main exposure/contamination routes were the digestive (51.66%) and respiratory (35.08%) tracts. The percentages were similar between men and women in the first case and very different in the second[26,27] and may be related to the circumstances of exposure/contamination: we found that in this variable, the highest notification percentages were in this order: accidental (49.17%), attempted suicide (32.60%) and environmental (14.64%). We observed a strong male predominance in

Table 3. Distribution of the reported cases of agricultural pesticide poisoning by gender, age and occupation in Tocantins from 2010 to 2014 (N = 262).

Variable	Male		Female		Total	%
	No.	%	No.	%	362	100
	250	69.06	112	30.94		
Age group						
< 1	1	12.50	7	87.50	8	2.21
1 to 9	19	44.19	24	55.81	43	11.87
10 to 19	25	52.08	23	47.92	48	13.26
20 to 29	66	72.53	25	27.47	91	25.14
30 to 39	52	76.47	16	23.53	68	18.78
40 to 49	37	86.05	6	13.95	43	11.87
50 to 59	32	74.42	11	25.58	43	11.87
> 60	18	100	0	0	18	5
Occupation						
Diverse agricultural workers	93	25.69	2	0.55	95	26.24
Other professionals	20	5.52	7	1.93	27	7.46
Housewife	2	0.55	18	4.97	20	5.52
Student	18	4.97	16	4.42	34	9.39
Retired/annuitant	6	1.66	0	0	6	1.66
Chronic unemployed	1	0.28	0	0	1	0.28
Empty (no information)	110	30.39	69	19.06	179	44.45

Source: SINAN/Tocantins.

Table 4. Distribution of the reported cases of agricultural pesticide poisoning according to selected variables in Tocantins, from 2010 to 2014 (N = 362).

Variables	Male		Female		Total	%
	No.	%	No.	%	362	100
	250	69.06	112	30.94		
Purpose						
Fungicide	12	3.31	3	0.83	15	4.14
Herbicide	86	23.76	12	3.31	98	27.07
Insecticide	82	22.65	24	6.63	106	29.28
Ignored/does not apply/other	43	11.88	66	18.23	109	30.11
Empty (no information)	27	7.46	7	1.93	34	9.39
Activity						
Storage	9	2.49	2	0.55	11	3.04
Harvest	3	0.83	1	0.28	4	1.10
Insect control	6	1.66	0	0	6	1.66
Dilution	50	13.81	6	1.66	56	15.47
Spraying	93	25.69	13	3.59	106	29.28
Transportation	1	0.28	0	0	1	0.28
Seed treatment	8	2.21	0	0	8	2.21
Ignored/does not apply/other	63	17.40	76	20.99	139	38.40
Empty (no information)	17	4.70	14	3.87	31	8.56
Route of Exposure/Contamination						
Skin	26	7.18	4	1.10	30	8.29
Digestive	92	25.41	95	26.24	187	51.66
Ocular	5	1.38	0	0	5	1.38
Respiratory	115	31.77	12	3.31	127	35.08
Another route	2	0.55	0	0	2	0.55
Ignored	2	0.55	0	0	2	0.55
Empty (no information)	8	2.21	1	0.28	9	2.49
Exposure/contamination circumstance						
Accidental	133	36.74	45	12.43	178	49.17
Environmental	50	13.81	3	0.83	53	14.64
Suicide attempt	56	15.47	62	17.13	118	32.60
Ignored/other	5	1.38	1	0.28	6	1.66
Empty (no information)	6	1.66	1	0.28	7	1.93
Work-related exposure						
Yes	129	35.64	4	1.10	133	36.74
No	115	31.77	106	29.28	221	61.05
Ignored	2	0.55	1	0.28	3	0.83
Empty (no information)	4	1.10	1	0.28	5	1.38
Exposure Type						
Repeated acute	23	6.35	8	2.21	31	8.56
Subchronic acute	2	0.55	0	0	2	0.55
Single acute	208	57.46	102	29.18	310	85.64
Ignored	13	3.59	1	0.28	14	3.87
Empty (no information)	4	1.10	1	0.28	5	1.38

Source: SINAN/Tocantins.

the accidental and environmental circumstances and a discrete predominance of females in cases of suicide attempts. The exposure/contamination circumstances interact mutually: the environmental may be more related to the spraying activity; the accidental has direct relation with the type of pesticide, with the activity and with the exposure/contamination route during the pesticide application. These are diverse conditions that contribute in one way or another to the occurrence of exogenous poisoning[2,24,25,26].

The high number of suicide attempts using the digestive route corroborates with other studies, and Tocantins resembles the situation of other Brazilian states, where several studies indicate the relation between suicide and the use of pesticides[1,20,27]. A study on pesticide poisoning in the micro region of Dourados, state of Mato Grosso do Sul, found a correlation between poisoning and suicide attempts by exposure to pesticides, especially in cotton and bean crops. Other examples are mentioned among rural workers in studies that highlight pesticides, mainly those in the organophosphate and carbamate groups, that cause acute and chronic poisoning related to neurotoxicity and mental disorders like irritability, depression, insomnia and disturbance of cognitive reasoning[1,27].

The association between suicides and pesticides is complex and raises questions about possible cause and effect relationships, whether it was the pesticide that generated the depression that led to the suicide or whether depression led to the use of pesticides to attempt the suicide. Notwithstanding the uncertainties, depression is a common reality among suicidal people and chronic use of pesticides has also been associated with depressive symptoms[20,28]. Be that as it may, we should be cautious about information based on SINAN's poisoning notification data, since they come from health services that mainly treat acute cases that require immediate care. Occupational chronic cases may be underestimated, overestimating acute cases, including suicide attempts[6].

Some active ingredients of pesticides can affect the central nervous system, mainly organophosphates, glyphosate, endosulfan, metamidophos, picloran and chlorpyrifos. They cause psychiatric disorders such as anxiety, irritability, insomnia or disturbed sleep (excessive dreams and/or nightmares) and depression, which can often lead the intoxicated person to ingest the poison used in the crop[5]. In addition, the predominant use of organophosphate insecticides in suicide attempts may reflect knowledge of this population about the acute toxicity of these chemicals[19].

We observed that more than 36% of the poisoning episodes were labor-related, with a significant predominance in males. According to estimates of the International Labor Organization (ILO), every year pesticides cause about 70,000 acute and chronic fatal poisoning cases among rural workers and an even greater number of nonfatal poisoning episodes[23]. Depending on the situation, working conditions are connected with environmental conditions, when workers are exposed to the effects of pesticides. An example is the increase in temperature associated with the presence of chemicals, which increases circulatory velocity, further enhancing skin absorption[31].

We verified that the main type of care in the health units is the hospital (77.62% of the cases), followed by outpatient assistance (20.72%). We also noticed there is a great demand for this type of unit in cases of acute poisoning, which happens in the great majority of cases registered in SINAN[27].

Other variables investigated were the final classification of the notified cases, the criterion used and the evolution of the case. Confirmed poisoning reached about 68% of the cases, while only exposure accounted for about 24%. This finding does not minimize the concerns, since the consequences of exposure may vary from person to person. The main criteria used to identify poisoning were the clinical (49.45%) and the clinical-epidemiological (41.99%). We observed only 2.49% of the laboratory criterion, which may also indicate difficulties of access to laboratory analysis.

Regarding the evolution of the case, the cure without sequelae occurred in 88.4% of the records. However, this percentage does not allow a complete analysis of this evolution, and we observed that in more than 7% of the cases, no information was available. It would require a more in-depth analysis of the living conditions of these people over time to know the actual severity of the poisoning they suffered.

As for the deaths, of the 5,437 exogenous poisoning cases reported during the analyzed period, 3,663 were confirmed, with a total of 35 deaths, representing a lethality of 0.95%. Of these 35 deaths, ten were related to pesticide exposure, eight of them agricultural and two domestic.

In the specific case of agricultural pesticides, of the 362 notifications, 246 poisoning episodes and eight deaths were confirmed. These specific deaths by agricultural pesticides compared to the 246 confirmed cases indicate a lethality of 3.25%. This is three times more compared to other types of toxic agents, which corroborates the severity of the problems caused by pesticides in Tocantins.

Regarding the distribution of cases of agricultural pesticide poisoning according to the crop and gender of those exposed, Table 5 shows that the highest percentage (77.34%) refers to the lack of information and that only a few crops cover data in this correlation perspective: we found a predominance of extensive monocultures, like, in this order, pastures, soybean, rice, maize and pineapple, with a predominance of males in the reports.

In general, there is a significant information deficiency in the SINAN/Tocantins database, which makes it difficult to estimate the association of poisoning with the type of toxic agent, active ingredient and crop, among other variables of health interest.

Despite the fact that not all the cases of pesticide poisoning result directly from exposure to a crop, there are many

Table 5. Distribution of the reported cases of agricultural pesticide poisoning according to gender and type of crop in Tocantins from 2010 to 2014 (N = 362).

	Male		Female		Total	%
	No.	%	No.	%		
Type of crop	250	69.06	112	30.94	362	100
Pastures	15	4.14	1	0.28		
Soybean	15	4.14	1	0.28	16	4.42
Rice	13	3.59	0	0	13	3.59
Maize	11	3.04	1	0.28	12	3.31
Pineapple	5	1.38	1	0.28	6	1.65
Watermelon	4	1.10	0	0	4	1.10
Eucalyptus	3	0.83	0	0	3	0.83
Avocado	2	0.55	1	0.28	3	0.83
Sugarcane	2	0.55	0	0	2	0.55
Lettuce	1	0.28	0	0	1	0.28
Banana	1	0.28	0	0	1	0.28
Beans	1	0.28	0	0	1	0.28
Soursop	1	0.28	0	0	1	0.28
Mustard	1	0.28	0	0	1	0.28
Tomato	1	0.28	0	0	1	0.28
Cotton	0	0	1	0.28	1	0.28
Empty (no information)	174	48.06	106	29.28	280	77.34

Source: SINAN/Tocantins.

notifications in the database that do not contain the type of crop, but tend to indicate this relationship when we cross compare this information with the type of activity, like spraying and dilution, among others[30,31,32,33].

CONCLUSIONS

The present study enabled us to characterize pesticide poisoning cases in Tocantins. Overall, we found that 22% of the notifying municipalities concentrate 84% of the notifications and a single municipality accounts for more than 40% of the notifications of these events.

The strong male predominance in the poisoning notifications by agricultural pesticides corroborates the studies on the subject. The most affected age groups are the ones that include the youngest productive workers, but all ages are affected, including children under nine years old or even under one year old. This shows of the severity of this public health problem and indicates the reach of exposure to these poisons.

Agriculture and livestock workers were the most affected occupational category, mainly males, but students, other professionals and housewives are also affected; although half of the notifications did not bear this piece of information, the result indicates the exposure of workers of several occupational categories to pesticides, mainly to herbicides and insecticides[24,26,27].

One of the characteristics of agricultural pesticide poisoning in Tocantins concerns the activity, which indicated, first, spraying, followed by dilution. The main exposure route was the digestive one, which affects both men and women in a similar manner. The next main exposure route was through the respiratory tract, which showed large differences between the genders, possibly related to the spraying activity, in which males predominate. The main type of exposure was acute unique (about 85%), followed by acute repeated, which represented one tenth of the first. However, considering the extensive exposure to these poisons, the predominant agricultural model and the ILO estimates[23] on acute, chronic, fatal and non-fatal poisoning episodes, annually, among rural workers, probably the situation is much worse and indicates an urgency to implement occupational health surveillance[33] and effective control measures to the use of these poisons.

Another important characteristic is the exposure/contamination circumstance, which in half of the events is accidental and notably more frequent in men. This characteristic is enhanced in environmental circumstances, indicating the importance of the occupational exposure. Another fact that also stands out is that there were no great differences between men and women on suicide attempts, which represented about 1/3 of the poisoning cases.

Although data from poisoning reports indicated a high percentage of evolution to cure - which is related to the acute

nature of the poisonings - they also showed that agricultural pesticide lethality is three times higher than that estimated for other toxic agents. This shows the harmful potential of these chemicals[33].

This work points out to the need to deepen the studies that, among others, deal with chronic poisoning and to the necessary efforts of the Brazilian Single Health System (SUS) to promote strategies to effectively implement policies that have already been formulated, like the Surveillance of Populations Exposed to Pesticides, and value and improve the information on health services. This could strongly subsidize efforts to plan health actions, mainly on worker and environmental health surveillance.

In 2017 there were 1,515 poisoning notifications by all the toxic agents in Tocantins. Of these, 178 notifications refer to the three types of pesticides (for agricultural, domestic and public health uses). Specifically related to agricultural pesticides, there were 105 cases, about 59% of the total. This is a much higher percentage than that found in this study, which requires studies on related factors.

In a scenario of increasing use of pesticides in Tocantins, as elsewhere in Brazil, and of expansion of the agricultural frontier with the predominant model of monoculture with intensive use of pesticides, the challenge to regulate these chemicals grows, especially in view of the approval, in 2018, in the Special Committee of the Chamber of Deputies, of Bill n. 6.299, of March 13, 2002, the so-called "Poison Package", which intends to withdraw regulatory prerogatives from the Ministry of Environment and from the Brazilian Health Surveillance Agency (ANVISA)/Ministry of Health and facilitate the use of pesticides that are banned in other countries in Brazil.

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Conflict of Interest

Authors have no potential conflict of interest to declare, related to this study's political or financial peers and institutions.