

# **ANALYSIS OF HEALTH DATA ON CHILDREN AND ADOLESCENTS FROM MUNICIPALITIES WITH THE HIGHEST NUMBER OF AERIAL SPRAYING OF PESTICIDES IN THE STATE OF SÃO PAULO - BRAZIL, BETWEEN 2013 AND 2015**

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**Abstract:** Brazil has been the largest consumer of pesticides in the world since 2008. The State of São Paulo, with 645 municipalities, stands out as one of the largest consumers and with the highest amount of pesticides sold in 2014 (23.5% of the national total), also being highlighted with the highest number of notifications for poisoning by pesticides in the country. The objectives of the study were to analyze the health data of children and adolescents in regions with high exposure to pesticides, in order to seek possible relationships between pesticide use and illness. A descriptive study was carried out from the analysis of hospitalization of children and adolescents between 0 and 19 years of age, in the 15 municipalities of the State of São Paulo, with the highest amount of aerial spraying of pesticides, between 2013 and 2015. Data were collected on the hospital mortality rate, by place of residence, based on the Unified Health System (DATASUS). Among the 15 municipalities with the highest consumption of pesticides in the State of São Paulo, high rates of congenital malformations and neoplasms were pointed out in comparison with data from the State of São Paulo. The findings of high rates of diseases in the municipalities studied point to the need for further research on the effects of the use of pesticides and aerial spraying on the population.

**Keywords:** Child, adolescent, pesticide, infant mortality.

## INTRODUCTION

Since the 1960s, Brazil has gone through an increase in the incentive of monoculture and the use of pesticides, through field modernization policies which were based on tax exemptions granted to the pesticide industries. With these measures, Brazil has become one of the largest consumers of pesticides in the world, having increased the

national pesticide market by 190% between 2000-2010, against only 93% of global growth.<sup>1</sup>

The net revenue of 25 billion reais in industries in 2014 demonstrates how much is invested by the Brazilian government in the growth of agriculture.<sup>1</sup>

Data from the Ministry of Health in 2013, the states that most traded pesticides were Minas Gerais, Rio Grande do Sul, Goiás, Mato Grosso and São Paulo, and the latter sold 1/4 of the pesticides that were used in Brazil.<sup>1</sup>

The commercialization of pesticides per planted area in 2013 indicates that the states with the highest number were, respectively: Rio de Janeiro, São Paulo and Alagoas. When we add the number of pesticide factories and household disinfectants, the first place is São Paulo, Paraná, Rio Grande do Sul and Minas Gerais. These numbers show the need for extensive inspection in these areas, with a greater focus on the health of workers and adjacent populations that come into contact with pesticides.<sup>1</sup>

One of the major concerns is also the use of pesticides by the agriculture, logging, forest management, industrial production, road preservation, public health and algae control sectors. It can be noted that not only one area is affected by its use, but several, with repercussions on the Brazilian population and national economy.<sup>1</sup>

Most of the costs related to the use of pesticides for the recovery of contaminated areas, prevention, diagnosis and treatment of acute and chronic poisoning, absence from work, retirement, death and disability of rural workers are supported by public money. Monetary investment is then diverted from other sectors to resolve the damage caused by the indiscriminate use of these substances.<sup>1</sup>

Pesticides poisoning can be classified as mild, moderate or severe according to factors such as exposure time, agent concentration, substance toxicity, and the time elapsed

between contact and seeking health care. Among several consequences caused by contact with pesticides, some of them are allergic conditions, endocrine, metabolic and reproductive disorders, with no predilection for age or sex. Direct workers are the most affected. According to the Ministry of Health, in the period between 2007-2014 there was an 87% increase in cases of exogenous poisoning by pesticides.<sup>1</sup>

Studies point to a direct relationship between pesticides and cancer in people who come into contact with some of these substances. And other studies seek to find the relationship between each pesticide compound and the most commonly caused cancers, such as soft tissue sarcoma, lymphoma, non-Hodgkin's lymphoma, leukemia, and, less frequently, lung cancer and breast cancer.<sup>3</sup>

There is also evidence that some pesticides are related to malformations in newborns whose mothers were exposed during pregnancy. Studies show an association between pesticide exposure and genital, hip, nervous system, extremity and palate malformations.<sup>4</sup>

Exposure to pesticides occurs from a variety of sources, not only through direct contact and food, but also through water consumption. According to current legislation, there is a maximum value allowed for each substance in the water, however, the exact consumption threshold of a certain component for systemic repercussions on the individual is not known.<sup>2</sup>

Due to the growing investment in pesticides and their application in the country, it is considered that the exposure of the population to potentially toxic substances is progressively greater, whether in the form of contaminated food and water or direct occupational or residential contact. This way, it is the commitment of the Health sector to consider human exposure to pesticides a public health issue and to find adequate preventive and

therapeutic strategies to combat its negative repercussions.<sup>1</sup>

## GOALS

The present work aims to analyze the health data of children and adolescents, between 0 and 19 years of age, among the 15 municipalities in the State of São Paulo with the highest incidence, in number of flights, of aerial spraying of pesticides between 2013 and 2015.

## METHODS

This is an ecological descriptive study, based on a survey of data on the aerial spraying rate in Municipalities in the State of São Paulo (SP), health data and demographic data.

The selection of the 15 Municipalities in the State of São Paulo with the highest aerial spraying of pesticides in the period from 2013 to 2015 was obtained through the Center for Research in Environmental Risk Assessment (NARA) (Nardocci, 2018), which related higher rates to the following municipalities listed in Table 1.

Data on the health profile of children and adolescents aged 0 to 19 years in the selected municipalities and in the entire State of São Paulo were obtained through the online platform, Department of Informatics of the SUS of the Ministry of Health (DATASUS/MS), through which the section "health information (TABNET)" and the group "epidemiological and morbidity" were used to obtain the profile of "Hospital morbidity of the SUS", general by place of residence, in the age groups from 0 to 4 years old, 5 to 9 years old, 10 to 14 years and 15 to 19 years, from January 2013 to December 2015.

Demographic and socioeconomic data on population estimates by municipality, sex and age from 2000 to 2015 were also obtained from the DATASUS/MS platform. The resident population per municipality was selected

City	Flights	2013	2014	2015
Miguelopolis	523	63	322	138
Barretos	286	41	83	162
Colina	184	49	47	88
Casa Branca	148	37	72	39
Jaboticabal	142	49	41	52
Guaira	128	36	72	39
Olimpia	127	43	26	58
São Joaquim da Barra	109	42	40	27
Palestina	107	27	29	51
Paulo de Faria	106	31	29	46
Sete Barras	104	36	36	32
Eldorado	101	33	36	32
Registro	96	35	33	28
Altair	95	32	26	37
Guaraci	94	37	18	39
Itariri	93	29	35	29
Juquia	93	31	34	28
Orindiuva	93	33	30	30
Ipuã	92	12	40	40
Buritizal	91	24	27	40
Total		3095	3473	4208

Table 1. The 20 municipalities with the highest frequency of area spraying in the State of São Paulo between 2013 and 2015

(Source: NARDOCCI, 2018)

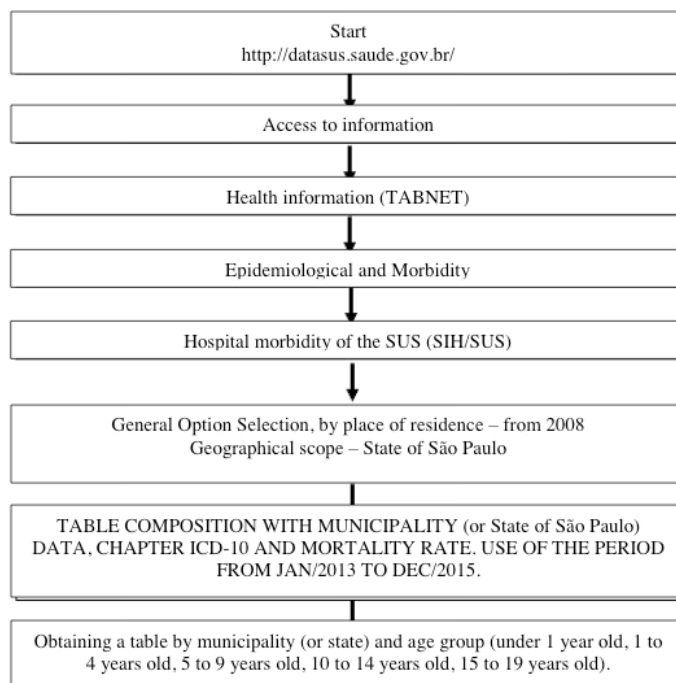


Figure 1. Methodological flowchart (Source: The Authors)

from 2013 to 2015, in age groups from 0 to 4 years, 5 to 9 years, 10 to 14 years and 15 to 19 years.

From the population data obtained from DATASUS/MS, the mortality rate of the 15 municipalities was calculated, in the established period and age group; as well as the mortality rate of the State of São Paulo with the same characteristics for comparison of information.

A comparison was made between the most frequent etiologies of mortality from 0 to 19 years of age at the State and municipal level, with an analysis of the 15 municipalities individually, showing the number of deaths per chapter according to the International Classification of Diseases (ICD-10).

Analyzes and calculations were performed using measurements and graphs.

The study is in accordance with Resolution No. 510 of April 7, 2016, of the Plenary of the National Health Council.

## RESULTS

Municipal data on morbidity and mortality in children and adolescents aged 0 to 19 years in the period from 2013 to 2015 were similar to the State total, with the exception of the ICD-10 chapters "Congenital Malformations and Chromosomal Anomalies" (chapter XVII) and "Neoplasms" (chapter II). These showed higher rates in the 15 municipalities with the highest aerial spraying of pesticides, compared to the total of the State of São Paulo. (Table 2)<sup>5</sup>

In 11 of the municipalities evaluated (including Barretos, Casa Branca, Colina, Eldorado, Jaboticabal, Miguelopolis, Olimpia, Palestina, São Joaquim da Barra), congenital malformations ranked second as the leading cause of mortality in the analyzed population profile (Table 2). In the State of São Paulo, however, it ranks as the 3rd leading cause, with a mortality rate of 2.41 per 100,000

inhabitants (Figures 4 and 5).

It was observed in the study that among the 15 Municipalities in the State of São Paulo with the highest rate of aerial spraying, 4 had neoplasms as the 2nd or 3rd leading cause of mortality in the analyzed population profile: Palestina, Sete Barras, Barretos, Olimpia; while at the State level, this etiology ranks 4th, with a mortality rate of 1.92 per 100,000 inhabitants (Figure 4, Tables 2 and 3).<sup>5</sup>

Such data corroborate a possible relationship between regional exposure to pesticides and illness, but it was not possible to certify the information.

## DISCUSSION

The Ministry of Health reveals that there was an increase in planted area in the State of São Paulo from 2007 to 2013. However, the increase is not proportional to the increase in the amount of pesticides used in the same area (Figure 2).

According to data from the Ministry of Health, the increase in the amount of pesticides (119% from 2007 to 2013) used per planted area raises productivity in a discrete way. 45% of the total substances).<sup>1</sup>

In the same period of analysis of pesticide marketing by planted area, a total of 12,562 notifications can be observed in pesticide poisoning notification data in the State of São Paulo from 2007 to 2014, an increase of 270%.<sup>1</sup>

The relationship between the rate of congenital malformations and the use of pesticides is observed in the literature, according to maternal occupational exposure or residence in contaminated areas.<sup>4</sup>

According to reports from the National Cancer Institute (INCA) and the Ministry of Health, there are multiple sources of exposure to pesticides, corroborating the hypotheses of maternal contamination with gestational repercussions. Our study, however, did not

Municipalities with the highest aerial spraying in the State of SP in the period from 2013 to 2015	Deaths by residence by ICD-10 chapter and year of death					
	Chapter II ICD-10 “Congenital Malformations and Chromosomal Anomalies”			Chapter XVII ICD-10 “Neoplasms”		
	2013	2014	2015	2013	2014	2015
Barretos	3	2	2	2	1	0
Casa Branca	1	2	1	0	1	0
Colina	1	1	1	*	*	*
Eldorado	2	0	0	*	*	*
Guaira	*	*	*	0	0	1
Guaraci	1	0	0	*	*	*
Jaboticabal	5	1	3	*	*	*
Miguelopolis	0	1	2	1	0	0
Olimpia	1	4	1	0	0	3
Palestina	1	0	*	0	1	*
Paulo de Faria	*	*	*	*	*	*
Registro	1	2	2	*	*	*
São Joaquim da Barra	2	1	1	0	0	1
Sete Barras	*	*	*	0	2	0
Altair	*	*	*	*	*	*

\* data not available on the DATASUS online platform

Table 2. Mortality in cities in the state of São Paulo: deaths by residence, ICD-10 chapter and year of death according to age group younger 1 year, 1 to 4 years, 5 to 9 years, 10 to 14 years; in the period from 2013 to 2015.

(Source: DATASUS/MS)

**Mortality between 0 and 19 years old in the 15 municipalities of São Paulo in the period 2013 – 2015 (Source: Datasus/MS)**

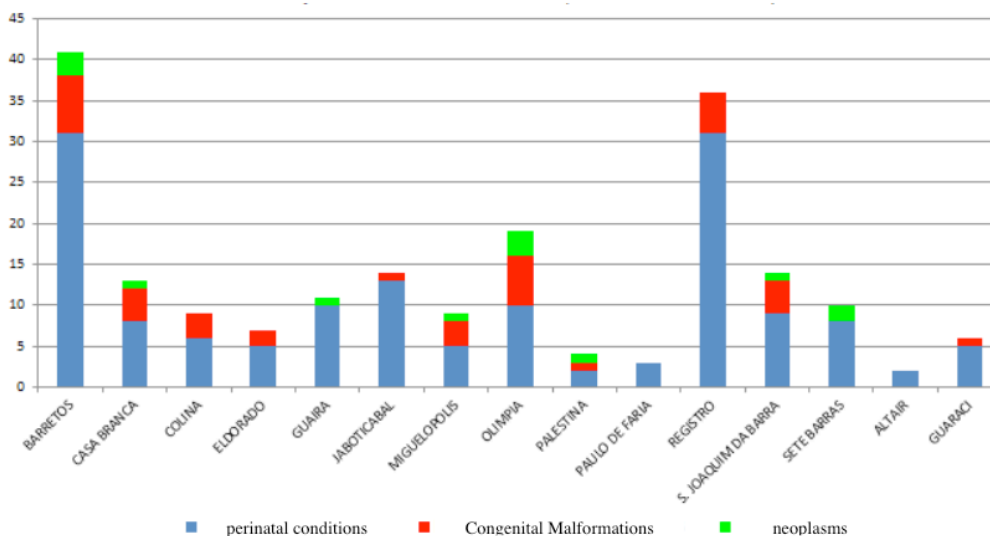


Figure 3. Mortality between 0 and 19 years old in the 15 cities of São Paulo from 2013 to 2015 (Source: DATASUS/Ministry of Health)

**Mortality between 0 and 19 years old in the 15 municipalities of São Paulo in the period 2013 – 2015 (Source: Datasus/MS)**

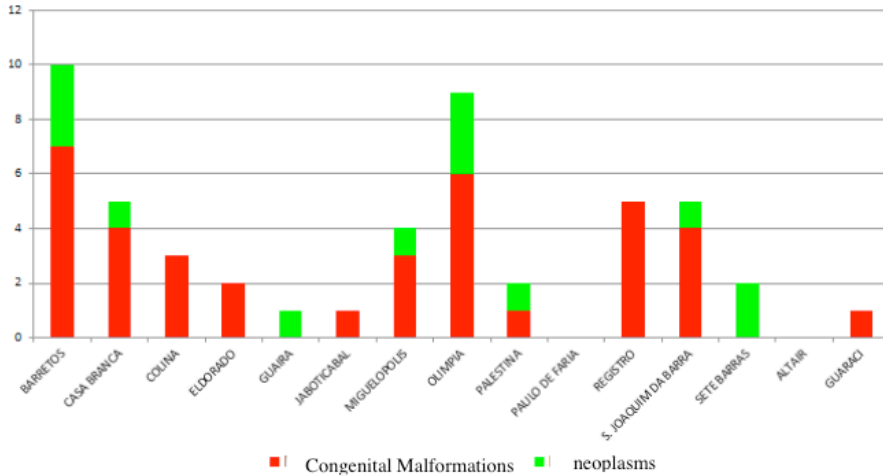


Figure 4. Mortality between 0 and 19 years old in the 15 cities of São Paulo from 2013 to 2015 due to congenital malformations and neoplasms (Source: DATASUS/Ministry of Health)

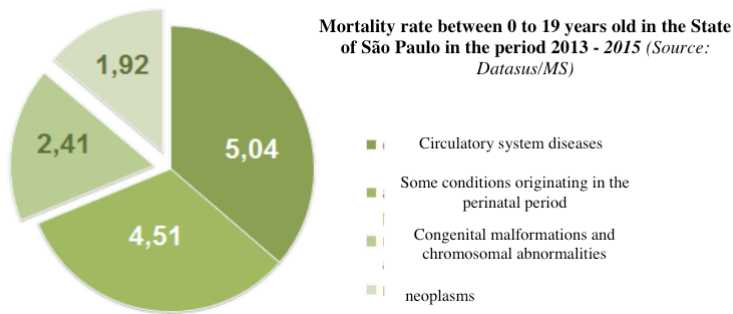


Figure 5. Mortality rate between 0 to 19 years old in the State of São Paulo from 2013 to 2015 (Source: DATASUS/Ministry of Health)

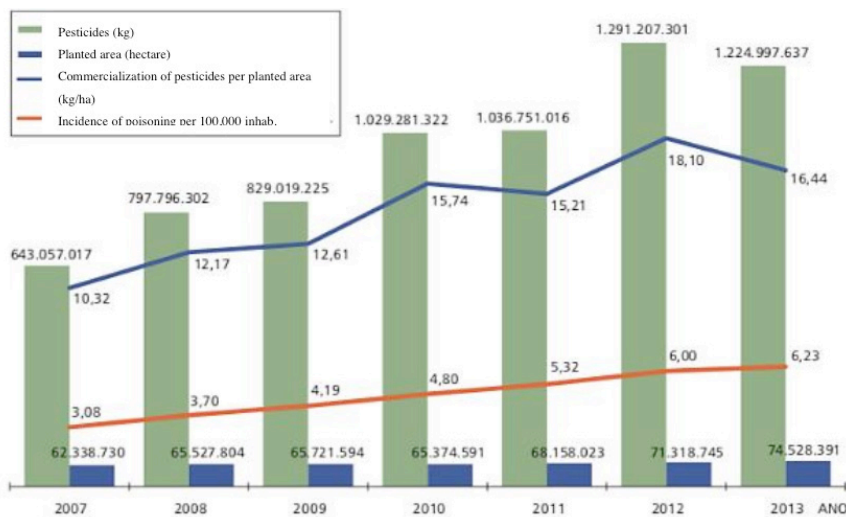


Figure 2. Commercialization of pesticides and the like by planted area (kg/ha) and incidence of pesticide poisoning – Brazil, 2007 to 2013 (source: Ministry of Health)



intend or establish relationships between gestational exposure to pesticides as a direct cause of congenital malformations.

## CONCLUSION

Municipal data on morbidity and mortality in children and adolescents aged 0 to 19 years from 2013 to 2015 show that chapters ICD-10 (II) “Congenital Malformations and Chromosomal Anomalies” and (XVII)

“Neoplasms”. had higher mortality rates in the 15 municipalities with the highest aerial spraying of pesticides, compared to the total of the State of São Paulo.

Such data corroborate a possible relationship between exposure to pesticides and illness, but it is not possible to certify the information. It is suggested that studies on the effect of aerial spraying and the use of pesticides in the population be carried out.

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