

INDUSTRIAL DEVELOPMENT AND HOSPITALIZATIONS FOR NEOPLASMS IN MATO GROSSO DO SUL- BRAZIL

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ABSTRACT

Introduction: The process of industrialization and urbanization impacts the environment and consequently the human health. Among health problems is the development of chronic diseases, where the risk of cancer has been the subject of scientific interest. **Objective:** To evaluate the relationship between economic and industrial growth and the increase in hospitalization rates due to neoplasms. **Method:** Ecological study, with secondary data on the Gross Domestic Product – GDP, resident population, and hospitalizations for neoplasms. The analysis units were the 78 municipalities in the state of MatoGrosso do Sul / Brazil, between 2002 and 2009. **Results:** There were positive correlations between industrial GDP per capita and rates of hospitalization for neoplasm. The economic and industrial development in the municipalities of Mato Grosso do Sul between 2002 and 2009 influenced the profile of hospitalization for neoplasm.

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INTRODUCTION

The quest for economic development is a standard feature in the capitalist world. The ideal outcome of this search is an economic growth where progress can be achieved without causing destruction, taking advantage of natural resources for the region's growth, improving people's living conditions, generating wealth without impacting the natural environment and the health of the population. The transition to a new paradigm of development is accompanied by innovations and changes in the way of thinking of societies, including the formulation of new development proposals (BUARQUE, 2008). Economic development is understood as a dynamic and sequential process (BALDWIN, 1979), which causes many changes, involves structural changes and improves economic and social indicators (SOUZA, 2007). It is common to find an association between the process of development and industrialization (THILWALL, 2005). In the territories chosen for its installation, new industrial plants are announced and received as a way of progress.

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Often they are received with open arms by governments and the majority of the population. The perspective of job creation and income generation, in often poor and vulnerable social contexts, becomes an incontestable and unquestionable appeal (RIGOTTO, 2008). Brazil is rich in natural resources, a fact that favors and stimulates the implementation of industrial plants in the different states of the federation. The country is one of the world leaders in the production and export of various agricultural products (raw and processed), among others. The process of industrialization and urbanization in the country has been occurring in an accelerated way and has a significant impact on the population, and cultural and sanitary dynamics of Brazil (CAMPOS; CERQUEIRA; NETO, 2011). Economic and industrial development in the state of MatoGrosso do Sul accelerated from the 1980s, with the advance of intensive agriculture, including for export, as well as ecological tourism and pulp and sugar-alcohol production industries (LIMA, PIFFER, OSTAPECHEN, 2016). The state stands out nationally, as it is in one of the fastest growing regions in the country, generating an increase in tax collection for the municipalities involved and better living conditions for the population, a fact that brought about a significant change in the state (CAMPESTRINI, 2010). The relationships between society, physical environment, and health are complex and

dynamic. Economic and social development has direct repercussions on the environment and also on human health, one of the consequences of which is the change in the morbidity and mortality profile (MENDONÇA, 1993). The impact of environmental problems generated by production and consumption processes on human health may manifest itself in the form of acute and/or chronic aggravations. The risks to human health associated with the use and exposure to agrochemicals can lead to chronic problems, specifically the risk of cancer (NUNES; TAJARA, 1998; GUERRA; GALO; MENDONÇA, 2005). Environmental degeneration can cause diseases and health problems. Studies carried out in different contexts and countries, related environmental causes to diseases, among these some types of cancer (BALDACCI *et al.*, 1979; HELLER, 1998; CANÇADO, 2006a; MENDONÇA, 1993; GUERRA; GALO; MENDONÇA, 2005).

Environmental sustainability associated with economic development is a present concern for several segments of society. Understanding the issues related to health and the environment is very important in determining the causes and the evaluation of health problems related to environmental contamination and conditions (RIGOTTO, 2003; RATTNER, 2009). Knowledge of environmental conditions, epidemiological aspects, and economically active activities are relevant for the establishment of measures to prevent injuries and reduce potential risks. In this context, an ecological study was conducted with the objective of evaluating the relationship between economic and industrial development and the rates of hospitalization for neoplasm. Environmental sustainability, associated with economic development, is a concern for several segments of society. Understanding the issues related to health and the environment is very important in determining the cause, and in evaluating health problems related to environmental contamination and conditions (RIGOTTO, 2003; RATTNER, 2009). Knowledge of environmental conditions, epidemiological aspects, and economically active activities are relevant for the establishment of measures to prevent injuries and reduce potential risks. In this context, an ecological study was conducted with the objective of evaluating the relationship between economic and industrial development and the rates of hospitalization for neoplasm.

MATERIALS AND METHODS

This ecological study verified the relationship between industrial development and the rates of hospitalization for cancer in 78 municipalities of MatoGrosso do Sul - Brazil between 2002 and 2009. The studied diseases (neoplasm) were selected according to criteria established by the World Health Organization for diseases related to environmental causes (WHO, 2007). Industrial and economic performance, measured by Gross Domestic Product (GDP), was obtained from the Federation of Industries of MatoGrosso do Sul (FIEMS) and from the State Secretariat of Environment for Science and Technology Planning of Technology (SEMACE). Resident population was originated from the Brazilian Institute of Geography and Statistics (IBGE). Hospitalizations for cancer, according to the International Statistical Classification of Diseases and Health Related Problems of the World Health Organization - Tenth Revision (ICD-10) (Figure 1), was obtained from the Hospital Internment System (SIH-SUS), via DATASUS. In order to characterize the economic development in the municipalities of MatoGrosso do Sul from

2002 to 2009, the following variables were used: number of industrial establishments; GDP at current price - industrial participation, Brazil, Central South Region (Midwest, Southeast, and South), MatoGrosso do Sul and its municipalities (2002 and 2009 average); population of MatoGrosso do Sul; Industrial GDP "per capita". The health condition of the population of MatoGrosso do Sul was analyzed by the occurrence of hospital admissions due to neoplasm, related to environmental factors (WHO, 2007), as shown in Figure 1. The analyzed variable was the rate of hospital admission for neoplasias per 10,000 inhabitants.

The influence of industrial economic development on the health of the population of MatoGrosso do Sul was verified by the analysis of the Person correlation coefficient between industrial GDP per capita and hospital admission rates for neoplasm per 10,000 inhabitants. Bivariate correlation analysis (Pearson) was performed between the independent variable (industrial GDP per capita) and the dependent variables (hospitalization rate) for all 78 municipalities, from 2002 to 2009. In this study, strong and very strong correlation was chosen as a single category, referred to as a strong correlation, with positive or negative values greater than or equal to 0.60. Moderate correlation (r between 0.30 and 0.60) and poor correlation (r less than 0.30).

The 78 municipalities of the state were divided by "per capita" GDP bands, according to the classification:

- **High:** Industrial GDP pc > 1.2 (Industrial GDP average pc)
- **Average:** 0.8 (industrial GDP average pc) ≤ Industrial GDP pc ≤ 1.2 (Industrial GDP average pc)
- **Low:** Industrial GDP pc < 0.8 (average industrial GDP pc)

These intervals made it possible to visualize the distribution of municipalities that presented a strong correlation ($r \geq 0.60$), positive or negative, by the per capita GDP value range according to the type of cancer. The analysis was performed using the Statistical Program for Social Sciences (SPSS), version 17.0. This research was approved by the Research Ethics Committee of the Federal University of MatoGrosso do Sul, protocol number: 2001 CAAE 0103.0.049.000-11.

RESULTADOS

Between 2002 and 2009, MatoGrosso do Sul presented an evolutionary industrial growth, a fact that is observed by the increase in the number of installed industries, from 3,160 in 2002 to 5,475 in 2009, a percentage increase of 73.26%. Among the 78 municipalities in the State, 68 had an increase in the number of industries, varying the growth between 8.33% and 800.00%. Only four municipalities did not change the number of industries and five decreased. Industrial activity was present in about 88% of the municipalities. MatoGrosso do Sul, from 2002 to 2009, had a population increase of 10.27%. In the same period, when analyzing current prices (Real) of industrial GDP, the State grew by 157.92%, compared to the Central South Region (116.74%) and Brazil (117.68%). Figure 2 and Figure 3 show maps of the "per capita" industrial GDP distribution in the state of MatoGrosso do Sul, years 2002 and 2009, respectively. To verify industrial development at the 78 municipalities of the state, they were aggregated in low, medium and high "per capita" industrial

Disease group	List
Malignant neoplasms of respiratory and intrathoracic organs	C32 - Malignant neoplasm of larynx C33 - Malignant neoplasm of trachea C34 - Malignant neoplasm of bronchus and lung C30 - Malignant neoplasm of nasal cavity and middle ear C31 - Malignant neoplasm of accessory sinuses C37 - Malignant neoplasm of thymus C39 - Malignant neoplasm of other and ill-defined sites in the respiratory system and intrathoracic organs
Other neoplasm	C61 Malignant neoplasm of prostate C67 Malignant neoplasm of bladder C64 - Malignant neoplasm of kidney, except renal pelvis C65 - Malignant neoplasm of renal pelvis C66 - Malignant neoplasm of ureter C68 - Malignant neoplasm of other and unspecified urinary organs C00-C14 - Malignant neoplasms, lip, oral cavity and pharynx C15 Malignant neoplasm of Esophagus C16 Malignant neoplasm of Stomach C18 Malignant neoplasm of colon C19 Malignant neoplasm of rectosigmoid junction C20 Malignant neoplasm of rectum C21 Malignant neoplasms of anus and anal canal C81 Hodgkin's Disease C82-C85 Non-Hodgkin's lymphoma C91-C95 Leukemia C88- Malignant immunoproliferative diseases C90, Multiple myeloma and malignant plasma cell neoplasms C96 - Other and unspecified malignant neoplasms of lymphoid, haematopoietic and related tissue

Source: Prepared by the author.

Figure 1. Group of diseases and respective diseases of Chapter II - Neoplasms, selected according to the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10)

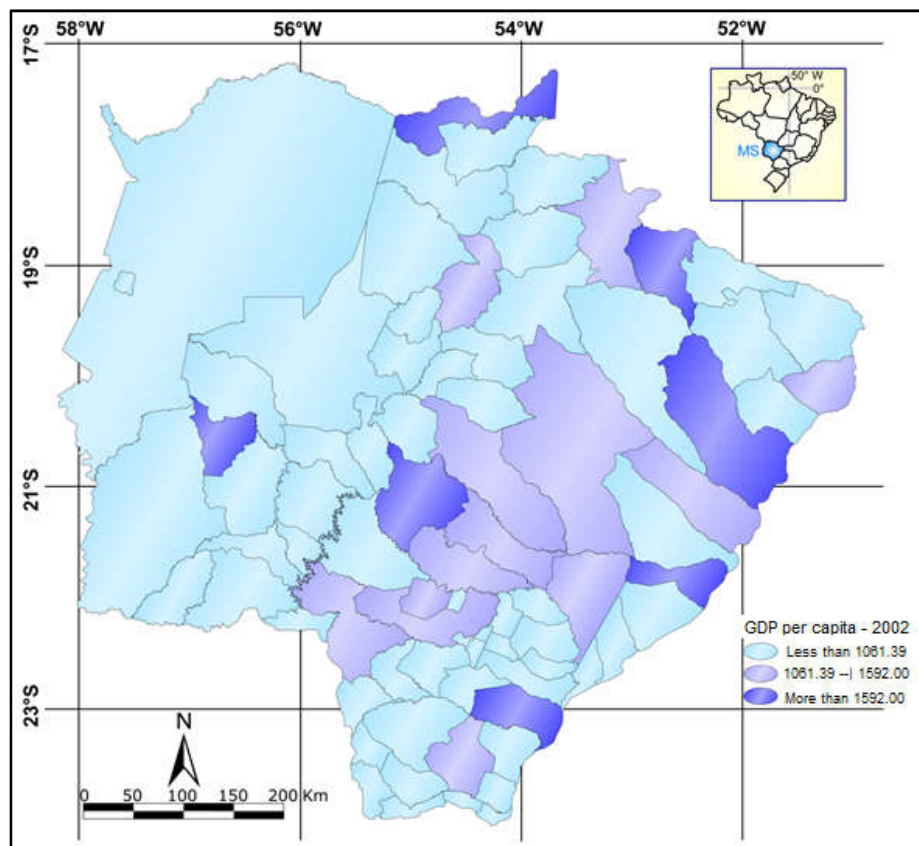


Figure 2. Distribution of annual "per capita" industrial GDP, Mato Grosso do Sul - 2002

GDP, as shown in Table 1. The results of the Pearson's correlation (strong positive, strong negative, weak or non-existent) between the industrial GDP per capita and the rates of hospitalization for neoplasm is in Table 2. The occurrence of neoplasm in the municipalities was divided according to the "per capita" GDP values and classified as high per capita GDP,

average per capita GDP and low per capita GDP. Table 3 shows the number of municipalities that had a strong positive or negative correlation between the industrial "per capita" GDP and the rate of hospitalization for neoplasm from 2002 to 2009.

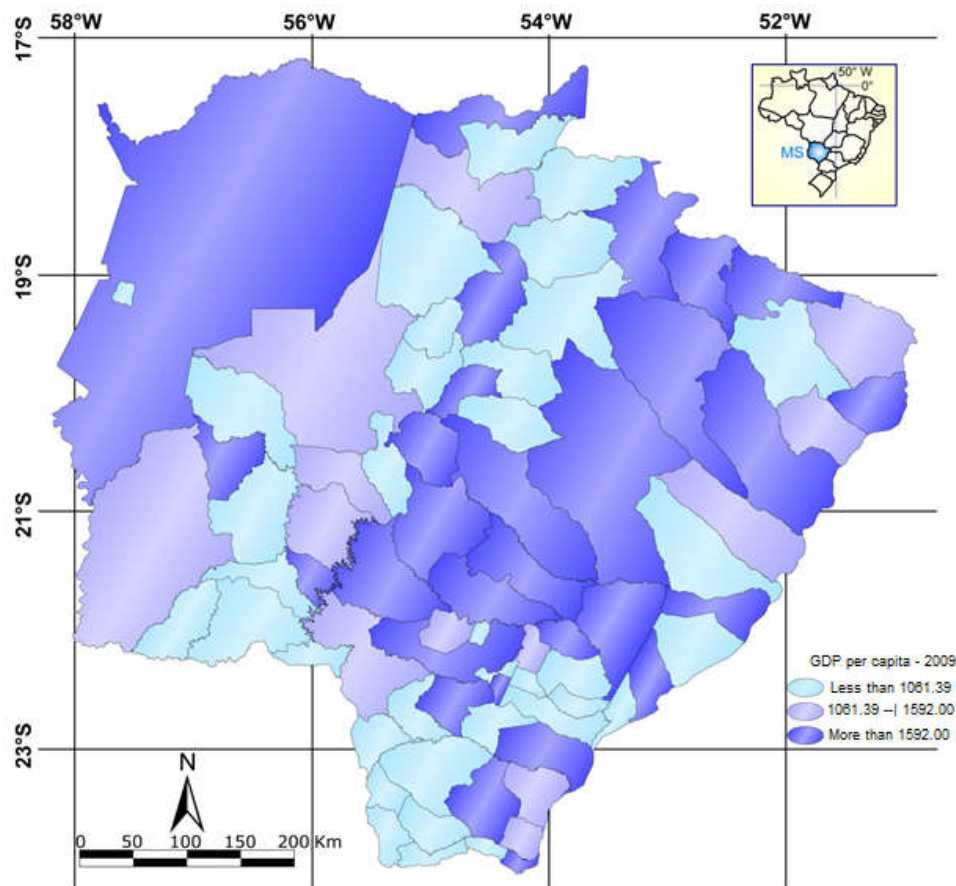


Figura 3. Distribution of annual "per capita" industrial GDP, Mato Grosso do Sul – 2009

Table1. Number of municipalities according to year and industrial GDP "per capita", Mato Grosso do Sul - 2002 and 2009 (n=78)

Industrial GDP "per capita"	2002	2009
Low	58	36
Medium	7	13
High	13	29

Table 2. Number of municipalities according to the correlation between the per capita GDP and the hospitalization rate by type of cancer, Mato Grosso do Sul – 2002 and 2009 (n=78)

Type of cancer	Correlation		
	Strong positive	Strong negative	Weak or nonexistent
Malignant neoplasms of respiratory system	14	1	63
Other types of cancer			
prostate	11	-	67
Digestive system	15	-	63
Bladder and urinary tract	8	2	68
Skin	10	-	68
Leukemia and cancer of lymphatic tissues	7	2	69

Note: (1) Strong positive = Pearson's correlation $r \geq 0.60$.

(2) Strong negative = Pearson's correlation $r \geq -0.60$.

(3) Weak or nonexistent = Pearson's correlation $r < \pm 0.60$.

Table 3. Number of municipalities with strong correlation (r Pearson ≥ 0.60) - positive and negative - by per capita GDP value range according to the type of cancer, Mato Grosso do Sul - 2002 and 2009

Type of cancer	GDP per capita Positive strong correlation			GDP per capita Negative strong correlation		
	High	Medium	Low	High	Medium	Low
Malignant neoplasms of respiratory system	9	-	5	-	1	-
Other types of cancer						
Prostate	3	1	7	-	-	-
Digestive system	9	1	5	-	-	-
Bladder and urinary tract	4	1	3	-	-	2
Skin	4	2	4	-	-	-
Leukemia and cancer of lymphatic issues	1	1	5	-	1	1

Note: (1) Strong positive = Pearson's correlation $r \geq 0.60$.

(2) Strong negative = Pearson's correlation $r \geq -0.60$.

DISCUSSION

The present study evidenced a significant increase in economic development in the state of Mato Grosso do Sul, superior to that presented in the Center-South Region and Brazil, from 2002 to 2009. The industrial segment showed high levels of growth in most municipalities. The growth rate had varied from 8.33% to 800.00%. Of the 78 municipalities in the state, industrial activity grew in 88% of these, influencing practically all regions of the state, changing the characteristics of municipalities in the most diverse physical, social, geographic and environmental aspects. According to Souza (2007), economic development is defined as the existence of continuous economic growth, in a rhythm superior to the demographic growth, a fact that happened in the State of Mato Grosso do Sul between the years 2002 to 2009. According to Campestrini (2010), there was a change in the economic matrix of Mato Grosso do Sul, which was previously focused on the agricultural sector, indicating a significant and growing evolution in the sectors of trade and services and industrial. Many strategies are used, among them the stimulus to industrial growth, to achieve economic growth. However, it is necessary to consider aspects related to the environment and the health of the population. Sustainable development can be understood as a process that leads to an increase in the quality of life, based on an efficient and competitive economy, combined with conservation of natural resources and social inclusion (RIGOTTO, 2003; RATTNER, 2009).

The industrial development occurred in Mato Grosso do Sul is perceived by the increase of the industrial GDP in the state, also by the increase of the industrial GDP "per capita" in the municipalities. This fact interferes directly with the local economy, as it favors growth, stimulates progress and implementation of policies that improve the quality of life of the population. When the pace of economic growth is higher than the population growth of a population, there is an increase in "per capita" income (BALDWIN, 1979). When assessing health and its social determinants, GDP is considered as an essential indicator of the quality of life of a population. Understanding the relationship between social determinants and health is a significant challenge, which is to establish a hierarchy between social, economic, and political factors and the mediations through which these factors influence and affect the health of groups and individuals (BUSS; PELEGRINI, 2007). This study indicates a strong positive correlation between the increase in industrial GDP per capita and the rates of hospitalization for cancer, drawing attention to the severe problem that is the increase in the number of cases of the disease and its relation with environmental issues. The results showed a strong correlation between industrial GDP per capita and hospitalization rate for neoplasm in 70 municipalities of the state. Most of these correlations were positive, indicating an increase in hospitalization rates due to neoplasm when associated to the increase of industrial GDP per capita. Among some factors contributing to the increase in cancer are changing in lifestyle and more exposure to specific environmental risks (GENDO, 1993; GALLO, MENDONÇA, 2005). According to these authors, the frequency of distribution of the different types of cancer varies according to regional characteristics, emphasizing the need to study the geographic variations in the patterns of this disease in order to obtain adequate monitoring and control. Studies show a progressive increase in chronic and degenerative diseases in Brazil, where demographic, economic and social changes

result in a considerable increase in the number of cases of diseases, among them cancer. Amid the factors that have contributed to the increase in cases, we can mention: exposure to different environmental risk factors related to the industrialization process - chemical; physical and biological agents; among others (MENDONÇA, 1993; GUERRA; GALO; MENDONÇA, 2005).

According to WHO (2002), cancer is a significant public health problem in developed and developing countries, accounting for more than six million deaths each year, accounting for about 12% of all causes of death in the world. Among the factors contributing to these figures is the global industrialization process (GONDIM *et al.*, 2008). Some types of cancer have a close relationship between the highest rates of mortality incidence and the countries with the highest economic development and tend to increase in the nations in economic transition (GARÓFOLO *et al.*, 2004). When the incidence of cancer is associated with developed and developing countries, it is necessary to highlight the aspects that are involved. The frequency of distribution of different types of cancer varies depending on the characteristics of each region, which emphasizes the need for studies on geographic variations in the patterns of this disease, as well as the understanding of environmental factors related to cancer.

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