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IMPACT ON PUBLIC HEALTH DUE TO WATERBORNE DISEASES DUE TO LACK OF BASIC SANITATION IN THE STATE OF MATO GROSSO, BRAZIL

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ABSTRACT

INTRODUCTION: Basic sanitation refers to the set of measures and services aimed at protecting public health and the environment, such as: drinking water supply, sanitary sewage, solid waste management and urban drainage (BRASIL, 2007). On the other hand, the term environmental sanitation refers to the "control of all factors in the physical environment of the human being that exert or may exert harmful effects on physical, mental and social well-being" (World Health Organization – WHO / Word Health Organization – WHO, (1950).

Keywords: Waterborne diseases. Sanitation. Public health in Mato Grosso.

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Revista ARACÊ
ISSN: 2358-2472

INTRODUCTION

Basic sanitation refers to the set of measures and services that aim to protect public health and the environment, such as: drinking water supply, sanitary sewage, solid waste management and urban drainage (BRASIL, 2007). On the other hand, the term environmental sanitation refers to the "control of all factors in the physical environment of the human being that exert or may exert harmful effects on physical, mental and social well-being" (World Health Organization – WHO / Word Health Organization – WHO, (1950).

On the national scene, Paulo S. Vasco (AGÊNCIA SENADO, 2022) states that about 35 million Brazilians do not have access to treated water, and 100 million do not have sewage collection, which results in preventable diseases that can lead to death from contamination. This reality, almost two years after the implementation of the New Legal Framework for Sanitation, sanctioned by Law No. 14,026/2020, when investments in the sector reached R$13.7 billion, proving to be insufficient to meet the goals established by the current legislation.

According to the National Water and Basic Sanitation Agency – ANA (2024), through Law No. 14,026/2020, a legislative framework of an administrative and regulatory nature was created so that all spheres of Government (federal, state, and municipal), as well as public administration bodies, autarchies, and civil society as a whole, join efforts to universalize access and effective provision of public basic sanitation services in Brazil.

In order for Brazil to be able to universalize sanitary sewage services (based on the 2035 planning horizon), the Sewage Atlas: Depollution of Watersheds, by ANA and the National Secretariat of Environmental Sanitation, points out that investments of R$ 149.5 billion are needed, of which R$ 101.9 billion need to be applied in sewage collection, while R$ 47.6 billion should be used in the treatment of these effluents. In Brazil, there are 60 subnational agencies operating in the sanitation sector, 25 state, one district, 28 municipal and six intermunicipal. In terms of coverage, approximately 65% of Brazilian municipalities are linked to these entities (AGÊNCIA SENADO, 2022).

At the national level, basic sanitation has been showing improvements, however, not enough to prevent cases of diseases related to this aspect. According to data from the Brazilian Institute of Geography and Statistics - IBGE, according to data from the last demographic census of 2022, in Brazil there is an estimated population of 203,080,756 million inhabitants, there is a demographic density of 23.86 inhabitants per square kilometer. Within this population picture, about 86% of the households interviewed have

Revista ARACÊ
ISSN: 2358-2472

garbage collected directly; 85.5% of the households have the general network as the main form of water supply; 63.2% of the households have sanitary sewage (general network or septic tank) connected to the network (IBGE, 2022).

When dealing with Basic Sanitation in the State of Mato Grosso, we found an estimated population of about 3.6 million inhabitants, about 87% of the population is served with treated water, and only 40.3% have access to sewage collection, while 40.9% of the sewage is treated, the rest is discharged without treatment into the environment every day, polluting our water bodies. In addition, the State loses about 45.4% of drinking water in the distribution systems, that is, all this volume is wasted before reaching Mato Grosso homes (TRATA BRASIL, 2024) (Chart 1). In this sense, it is possible to point out that the State of Mato Grosso has numerous challenges to meet, with regard to the universalization of basic sanitation by 2033.

According to the National Sanitation Information System (SNIS), the state of Mato Grosso has 142 municipalities, among them, only 40 municipalities reported having a sanitary sewage network. The other 102 municipalities in the state do not have or did not report any type of data regarding the collection and treatment of sanitary sewage. It is worth mentioning that CONAMA establishes, through Resolution No. 430 of 05/13/2011, that effluents from any polluting source can only be discharged directly into the receiving bodies after proper treatment and provided that they comply with the conditions, standards and requirements set forth in this Resolution, and in other applicable norms (CONAMA, 2011). Table 01 shows the relationship between the sanitation condition and the monthly income of the population of the Midwest region in the period from 2018 to 2022.

Table 01 – Summary of the sanitation condition x monthly income in the Central-West region in the period 2018-2022.

Midwest Region	2018	2019	2020	2021	2022
Share of the population without access to water (%)	11	10,3	9,1	10,1	11
Share of the population without sewage collection (%)	47,1	42,3	40,5	38,1	38,2
Number of total hospitalizations for waterborne diseases	20.509	27.738	17.252	13.384	23.307
Number of deaths from waterborne diseases	152	213	137	147	212
Monthly Income of people with sanitation (R$)	3.665,36	3.684,43	3.791,63	3.908,82	4.041,33
Monthly Income of people without sanitation (R$)	830,17	834,49	858,77	885,31	2.633,00

Source: Adapted, ITB (2023).

Revista ARACÊ
ISSN: 2358-2472

Based on information from the National Basic Sanitation System – SNIS (SNSA, 2022), the State of Mato Grosso invests about R$ 153.08 (one hundred and fifty-three reais and eight cents) per inhabitant in public works and services related to basic sanitation, while in the national scenario, the average is R$ 111.44 (one hundred and eleven reais and forty-four cents). Although the amount invested is higher than the national average, it is below what is necessary for universalization, as provided for in the State Plan for Basic Sanitation – PLANSAB. Therefore, to meet the goals established by the year 2033, the State of Mato Grosso must make investments of approximately R$231.09 (two hundred and thirty-one reais and nine cents) per capita (TRATA BRASIL, 2024).

The presence of an inefficient basic sanitation system, or even the lack of it in the urban areas of the State of Mato Grosso, has been a constant concern of public authorities, as the emergence of confirmed cases of waterborne diseases has been increasing. These diseases have always been considered a topic that, in a way, offers a lot of concern to society (AROUCA, 2017).

Diseases related to sanitation can be classified into four main groups: 1) feco – oral (ingestion of water or contact with water), examples are the following diseases: cholera, giardiasis, typhoid fever, polio, hepatitis A and leptospirosis. 2) Diseases related to hygiene, such as dermatophytosis and conjunctivitis. 3) Based on contamination through water: schistosomiasis and helminth infections. 4) Diseases transmitted by vector insects (vector reproduces in water): dengue; black vomit; filariasis; malaria (ICICT-FIOCRUZ, 2024).

OBJECTIVE

This article aimed to correlate sanitation devices with the environmental health index and waterborne diseases, or caused by vectors related to the absence of sanitation, and to present the condition of the State of Mato Grosso regarding the environmental health index.

METHODOLOGY

The methodology consisted of consulting and collecting data from the municipalities of the State of Mato Grosso, referring to basic sanitation aspects, such as: (water supply systems – SAA (IAB), sanitary sewage – SES (IES), urban solid waste collection – SCRSU (IRS)), obtained from the website of the Water and Sanitation Institute (IAS, 2024), as well as, related to the number of cases related to waterborne diseases such as: Dengue (D),

Revista ARACÊ
ISSN: 2358-2472

Schistosomiasis (E), Hepatitis A (H) and Leptospirosis (L), obtained from the DataSUS platform of the Ministry of Health (MS, 2024).

From the tabulation of these data, a table of the municipalities of the State of Mato Grosso was obtained, containing the following information: IBGE micro-regions; current population; population served by the SAA, SES, SCRU and SDU; and the number of occurrences in the period from 2013 to 2023, of the aforementioned diseases, except Hepatitis A, as there were no data available for 2023. The Vector Control Indicator – CVI was calculated according to equation 1.

LCI = (((D + E)/2) + L) /2 (1)

Where:

LCI is the Vector Control Indicator;

D is the sum of confirmed cases of dengue;

And it is the sum of confirmed cases of schistosomiasis;

L is the sum of confirmed cases of leptospirosis;

Applying the methodology proposed by Gama (2013), it was possible to calculate the Environmental Health Index (ISA) (equation 2) and the Disease Indicator (ID) (total number of disease occurrences per 100 inhabitants) (equation 3). The presentation of the data by the micro-regions was adopted, seeking to simplify the volume of data in the tables and graphs, so that the micro-regions better reflect the spatial characteristics when compared to the mesoregions of the state (north, northeast, south, southwest and center).

ISA = 0.3 IAB + 0.3 IES + 0.2 IRS + 0.2 ICV (2)

Where:

ISA is the Environmental Health Index (%);

IAB is the Water Supply Indicator;

IES is the Sanitary Sewer Indicator;

IRS is the Solid Waste Indicator;

LCI is the Vector Control Indicator;

ID = ((D + E + H + L) * 100) / Population (3)

Where:

ID is the disease index (per 100 inhabitants);

D is the sum of confirmed cases of dengue;

And it is the sum of confirmed cases of schistosomiasis;

H is the sum of confirmed cases of hepatitis A;

Revista ARACÊ
ISSN: 2358-2472

L is the sum of confirmed cases of leptospirosis;

The data were presented in the form of graphs, at the level of micro-regions, correlating them with the data obtained regarding the ISA, % of the MT Population and the ID. The ISA values were classified according to Table 02.

Chart 02 – Environmental Health Level as a function of the ISA score range.

Environmental Health Level as a function of the ISA score range			
0-25,0%	25,1-50,0%	50,1-75,0%	Above 75.1%
Unhealthy	Low healthiness	Medium Healthiness	Salubrious

Source: Teixeira, et. al. (2018).

RESULTS AND DISCUSSIONS

The average ISA in the state of Mato Grosso is 48.74%, being of low health (Chart 03). Of the 22 (twenty-two) micro-regions, only Rosário Oeste has an ISA classified as Unhealthy. None of the micro-regions of the state obtained an ISA classified as Salubre (Figure 01).

Table 03 – Environmental Health Index and Disease Index for each micro-region of the state of Mato Grosso. Source: Author's Author, (2024).

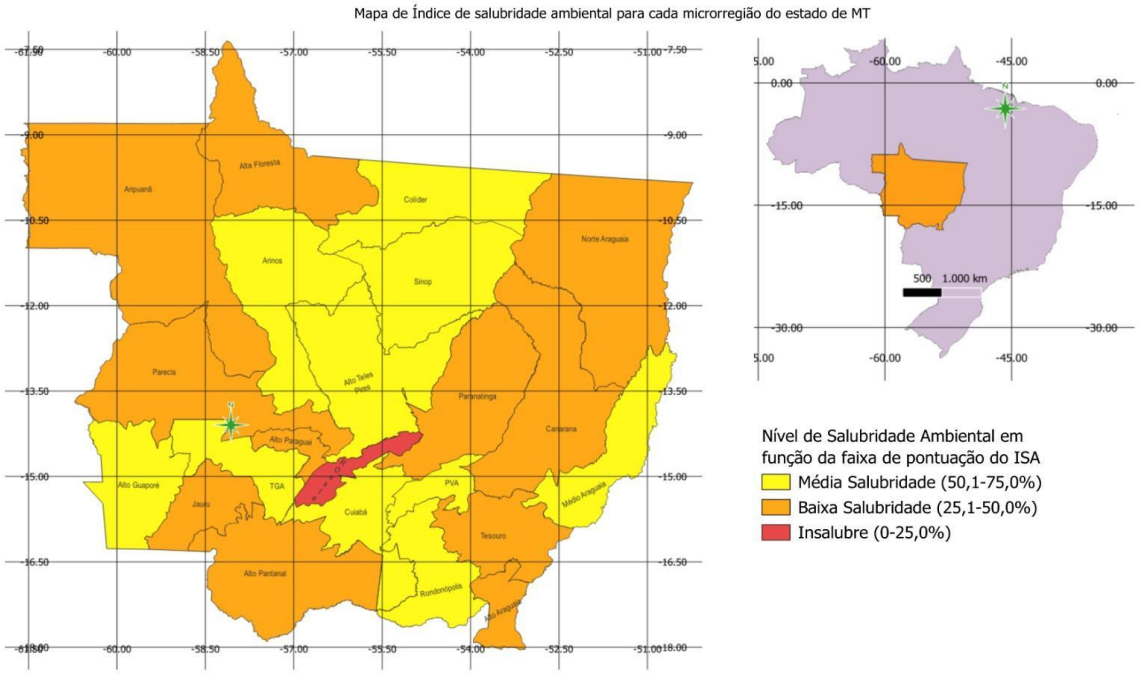
Microregion	Population	Population (%)	ISA	ID
Alta Floresta	111.154	3,04%	46,79%	13,35
Alto Araguaia	41.149	1,12%	47,90%	6,29
Alto Guaporé	82.126	2,24%	54,71%	5,82
Alto Pantanal	133.054	3,64%	46,41%	3,25
Alto Paraguai	30.589	0,84%	47,18%	4,01
Alto Teles Pires	310.294	8,48%	55,25%	8,63
Arinos	64.605	1,77%	55,19%	7,88
Aripuanã	145.500	3,98%	40,20%	8,38
Canarana	136.756	3,74%	48,27%	6,52
Colíder	144.042	3,94%	55,58%	11,03
Cuiabá	998.131	27,28%	66,18%	3,34
Jauru	101.422	2,77%	41,17%	5,03
Médio Araguaia	79.225	2,17%	66,33%	7,11
Norte Araguaia	130.825	3,58%	32,72%	5,87
Paranatinga	56.571	1,55%	33,43%	9,36
Parecis	123.844	3,38%	49,14%	9,67
Primavera do Leste	129.731	3,55%	71,27%	12,27
Rondonópolis	330.200	9,03%	71,03%	3,76
Rosário do Oeste	27.893	0,76%	8,52%	4,42
Sinop	259.093	7,08%	56,88%	13,49
Tangará da Serra	162.427	4,44%	52,52%	4,87
Tesouro	60.018	1,64%	25,64%	5,56
Estado de Mato	3.658.649	100,00%	48,74%	7,27

Revista ARACÊ
ISSN: 2358-2472

Grosso				

The micro-region of Cuiabá is the most populous in the state (27.28%) and has the second lowest ID (3.34) (Chart 03 and Figure 02). These results can be mainly related to the availability of basic sanitation services, especially those related to the collection and treatment of sanitary sewage. Similar values were found in the mesoregions of Alto Pantanal, Rondonópolis, Alto Paraguai, Rosário Oeste and Tangará da Serra. The worst results related to IDs were observed in the micro-regions of Sinop (13.49), Alta Floresta (13.35), and Primavera do Leste (12.27).

Figure 01 – Environmental health index for each micro-region of the state of Mato Grosso

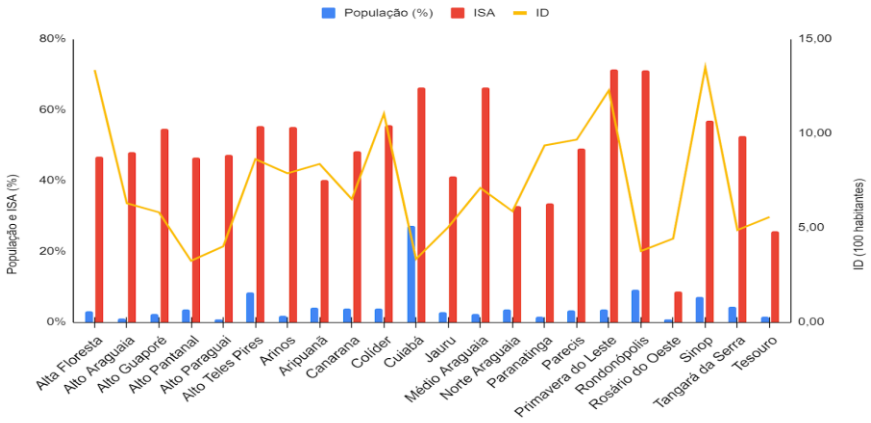


Source: Author, (2024).

The absence of a sewage collection network in most of the municipalities of the state has resulted in the disposal of sanitary sewage in septic tanks, rudimentary tanks and in ditches, rivers, streams and streams. Thus, this was the index that most contributed to the decrease of the ISA in the study area. Similar results were observed in the works carried out by Gama (2018).

Revista ARACÊ
ISSN: 2358-2472

Figure 02 – Relationship between the percentage of the population, Environmental Health Index and Disease Index for each micro-region of the state of Mato Grosso.



Source: Author, (2024).

It is believed that the numbers released by the IBGE may be mistaken, since many times the population itself does not have enough knowledge to differentiate between sewage collection network, septic tank and rudimentary tank and as the IBGE data collection occurs through interviews with residents, they may have been confused when answering. According to data collected by the SNIS (SNSA, 2022), about 56.0% of the population has a sewage network; more than 93 million Brazilians (44%) do not have access to sewage collection; 3.1% of children and adolescents do not have a bathroom at home; 38 municipalities among the 100 largest cities in Brazil have more than 90% of their population served by a sewage system; in Brazil, the proportion of municipalities with a sewage network increased from 47.3% in 1989 to 60.3% in 2017 (TRATA BRASIL, 2022).

With regard to the Brazilian regions, the northern region supplies sewage network to 14.7% (2.5 million) of the population; the Northeast region provides sewage network for 31.4% (16.9 million) of the population; the Southeast region provides a sewage network for 80.9% (68.5 million) of the population; the South Region supplies sewage network to 49.7% (14.9 million) of the population; and the Midwest provides a sewage network to 62.3% (10.1 million) of the population (TRATA BRASIL, 2022).

The data collected by the studies carried out by the SNIS (SNSA, 2022) brought the following numbers: only 52.2% of the country's sewage is treated; only 27 municipalities among the 100 largest cities in the country that treat more than 80% of sewage; In 2021, the percentage of untreated sewage represented 5.5 thousand Olympic swimming pools dumped every day into nature. Furthermore, still with regard to sewage treatment in Brazil, we could see that 19.8% of sewage is treated in the North region; 34.3% of sewage is

Revista ARACÊ
ISSN: 2358-2472

treated in the Northeast; 61.6% of sewage is treated in the Southeast region; 48.0% of the sewage is treated in the South region; and 59.3% of sewage is treated in the Midwest (TRATA BRASIL, 2022).

Access to drinking water and to solid waste collection and final disposal services represented the best ISA indices in all micro-regions of the state.

Through the ICV, high numbers of confirmed cases of dengue were observed. On the other hand, cases of schistosomiasis and leptospirosis were scarce. Thus, it is possible to infer that dengue is the main disease related to the decrease in this index. Thus, the fight against the vector (*Aedes aegypti*) would be enough to improve the situation of the ICV. This objective can be achieved with targeted public policies and, mainly, with the awareness of the population (KOBREN, et. al., 2019). Also, as it is a disease related to access to basic sanitation, the incidence of rotavirus was considered, however, there were no data available in DataSUS.

These data corroborate the growing increase in diseases that are transmitted through the properly treated water that is offered to a large part of the Brazilian population, as well as through the untreated domestic effluents that daily contaminate our water resources. We understand that in order to reduce this alarming number of confirmed cases of waterborne diseases, it is necessary that the public authorities at all levels of government meet the goals established by their Basic Sanitation Plans, in accordance with the goals and objectives of the new regulatory framework for basic sanitation, introduced through Federal Law No. 14,026/2020 so that the entire Brazilian population has access to these services with quality, to improve the quality of life.

No studies were found that determined the ISA in municipalities or in the state of MT. In a literature review on the determination of the index in Brazil, Teixeira et. al. (2018) identified 60 studies with the application of ISA in the country. Of these, only 3 were carried out in the central-west region, 2 in the state of Goiás and 1 in the state of Mato Grosso do Sul. Only 1 study was identified in the northern region of the country.

It is important to emphasize that the comparability between the results of the ISAs is restricted to only two situations: a) those that have the same composition, that is, the same weights and indicators of the first and second orders, as well as equal calculation and scoring criteria; b) by comparing the same ISA over time, making it possible to identify advances and setbacks in the socio-environmental components evaluated by the indicator.

Revista ARACÊ
ISSN: 2358-2472

As a result, it is suggested to standardize the ISA. Formulating a standard ISA is a challenge, due to the peculiarity of each site to be studied. However, this standardization will make it possible to compare the regions evaluated from the perspective of the same index and to prepare an environmental health ranking with the same weights and calculation criteria (BILMAYER, et. al, 2020).

FINAL CONSIDERATIONS

Each year, more regions are evaluated in the light of the ISA, which shows that its use has been strengthened and disseminated, especially in the academic sphere, and timidly employed by municipal governments in their sanitation plans. As it is intrinsic to the principles of an index, the ISA is able to base decisions of public managers in their deliberations, and provides an effective diagnosis of the environmental sanitation of the region under analysis, being able to point out potentialities and weaknesses of the services that compose it. In addition, the ISA is able to express the information contained in its final value in a simple and objective way.

However, more important than evaluating only the final value of the ISA is the understanding and interpretation of the particular results of each of its indicators, from which essential information can be extracted, making managers focus public investments aiming at improving the environmental health of a region.

The analyses referring to the quality of urban environments provide important results for decision-making by public managers, in order to guide urban planning actions that promote quality of life for the population, harmonizing and valuing the use of elements of nature.

Within this context, the analysis of the environmental quality situation in the state of Mato Grosso through the quali-quantitative diagnosis regarding the provision of environmental health services, such as water supply, sanitary sewage, collection and disposal of solid waste and vector control, are essential to the environment and, mainly, to public health. The feasibility of the proposed model was demonstrated, as well as the advance in the description of environmental health, showing the reliability of the information in the urban space.

It also demonstrates the potential of applying the ISA as an instrument for evaluating public policies for environmental sanitation.

Revista ARACÊ
ISSN: 2358-2472

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Revista ARACÊ
ISSN: 2358-2472

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