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# RELATIONSHIP BETWEEN BASIC SANITATION AND THE INCIDENCE OF INFECTIOUS DISEASES IN THE HEALTH MACRO-REGIONS OF THE STATE OF MARANHÃO

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## ABSTRACT

Basic sanitation is crucial for quality of life, as the lack of this service can spread infectious diseases due to lack of hygiene and access to drinking water. Data from 2019 indicate that 86.9% of the population of Maranhão does not have sewage collection, resulting in more than 38 thousand hospitalizations for waterborne diseases. This study aims to investigate the relationship between basic sanitation and the incidence of infectious diseases in Maranhão, highlighting the need for more effective sanitation plans. This is a descriptive study and uses a quantitative approach, collecting secondary data from DATASUS on the situation of sanitation and infectious diseases in the health macro-regions of Maranhão. The information was extracted through a specific process on the website, covering the period from 2014 to 2017. The data were organized in Excel spreadsheets for analysis and visualization. The results reveal that the northern macro-region of Maranhão has 55.98% of families without adequate sanitation, while the east and south have 29.44% and 14.57%, respectively. Schistosomiasis, a disease transmitted by contaminated water, had the most cases in the northern region of the state. The data indicate that regions with inadequate sanitation have high infection rates, demonstrating a correlation between the absence of sanitary sewage and the increase in diseases such as amoebiasis and schistosomiasis. The study concludes that the macro-regions analyzed show a clear proportional relationship between the inadequacy of sanitation and the incidence of infections, reinforcing the urgency of interventions in the area of sanitation to improve the health of the population.

**Keywords:** Basic Sanitation. Infectious Diseases. Waterborne Diseases. Sanitary Sewerage.

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## INTRODUCTION

The health regions are formed by municipalities with characteristics that encompass border proximity, mainly cultural, social and economic similarities. Aiming at the organization of health resources in line with the demand of each region. The set of health regions is called macro-regions and this division has the same organizational purpose and observation of demands (BRASIL, 2022).

Basic sanitation is defined as the "control of all factors in the physical environment of man that exert or may exert a deleterious effect on his physical, mental or social well-being" (WHO, 2004). Thus, we observe that this service is essential and is directly related to the maintenance of the community's quality of life. If it is not fully functioning, the deleterious effect mentioned above can be identified, for example, mainly through the various infectious diseases, which have conditions that favor transmission, such as lack of hygiene, access to drinking water, sewage treatment, and the collection and disposal of garbage in an appropriate way (UHR, 2016; PIOLI, 2017).

In addition, according to updated data from the Brazil Sanitation Panel together with Trata Brasil, which is a public interest organization focused on advances in basic sanitation and protection of water resources in the country, in 2019, they state that 86.9% of the population of Maranhão does not have sewage collection, which represents a total of 5,373,848 people from Maranhão. Also according to data from this platform, more than 38 thousand hospitalizations have already been registered for waterborne diseases, which are related to diseases caused by microorganisms in untreated or contaminated water (INSTITUTO TRATA BRASIL, 2018).

For example, according to DATASUS data, in the period from 2015 to 2017, about more than 260,000 people were hospitalized due to some infectious and parasitic disease - which according to the International Chapter on Diseases-10 (ICD-10) are exemplified as intestinal infectious diseases, zoonotic bacterial diseases, arbovirus fevers, protozoa, among others (BRASIL, 2008). From this perspective, this is a very high number of hospitalizations, many of which are caused by diseases whose main prophylaxis is basic sanitation, for example amoebiasis, which is a protozoa transmitted by contact with contaminated water or food (ALMEIDA, 2020). In view of this, this study aims to investigate the relationship between basic sanitation and the incidence of infectious diseases, based on data from public systems, on the Macro-regions of the state of Maranhão, as well as to foster discussions for the identification of potentially causal factors of diseases, for better

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implementation of public policies according to the demands of the health regions of the state, improving people's health and quality of life.

## METHODOLOGY

This article is a descriptive work, based on the quantitative approach. To obtain the data, searches were carried out on the DATASUS website (http://www2.datasus.gov.br) on data related to the situation of basic sanitation and data on infectious diseases in the health macro-regions of the state of Maranhão. These numbers constitute secondary data that make up the present study, in which, on the website, the options contained in "Statistical Information" and "Epidemiological and Morbidity" were selected. After that, the options "sanitation situation"; "Hospital morbidity"; "Schistosomiasis Control Program", referring to the state of Maranhão in division by health macro-regions.

Data were collected on the website as follows: http://tabnet.datasus.gov.br > Health Macro-regions (row) > Year (column) > 2014 and 2015 or 2014 to 2017 (period) > All content was selected > show. Then, the data were selected for analysis in a comprehensive way.

The data collected, related to the sanitation situation and incidence of infectious diseases in the health macro-regions of Maranhão, comprising the most current period available, December 2014 and from June to December 2015 (Sanitation) and from 2014 to 2017 (Incidence of infectious diseases), were tabulated in Excel spreadsheets (Microsoft Office® 2010), a program in which all the graphs and tables to be presented in the results were assembled. Next, data on relative frequency (RF = Absolute Frequency/Total Frequency of families or individuals x 100), absolute frequency and total frequency were selected. Therefore, since this was a study that used exclusively secondary data from an official database in the public domain, it was not necessary to submit and approve it by the Research Ethics Committee.

## RESULTS

According to data from DATASUS, related to the sanitation situation, in the period from December 2014 and from June to December 2015, in relative percentage frequency, the northern macro-region has 55.98% of families that do not have adequate basic sanitation, that is, more than half of the families without this service are part of this region,

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while the east has 29.44% and the south has 14.57% of families without the resource (table 3).

Table 1 - Population by health macro-region and number of tests performed and positive tests for schistosomiasis in the macro-regions of Maranhão, in the period from 2014 to 2017.

| Health macro-region | Population IBGE 2017 | Population worked | Tests performed(RF%) | Positive tests (RF%) |
|---|---|---|---|---|
| South Macro-region | 1.277.912 | | | |
| North Macro-region | 4.084.650 | 190.592 | 168.242 (93%) | 6.111(98%) |
| Eastern Macro-region | 1.591.474 | 15.172 | 12.571(7%) | 76 (2%) |
| Total | 6.954.036 | 205.764 | 180.813 (100%) | 6.187 (100%) |

Source: Ministry of Health - Primary Care Information System - SIAB and MS/SVS/ GT PCE

Table 2 - Families with sanitary sewage (ignoring those with septic tanks) in the macro-regions of Maranhão, in December 2014 and in the period from June to December 2015.

| Health macro-region | No. of families | FR% |
|---|---|---|
| South Macro-region | 123.612 | 26,46 |
| North Macro-region | 285.114 | 61,03 |
| Eastern Macro-region | 58.441 | 12,51 |
| Total | 467.167 | 100 |

Source: Ministry of Health - Primary Care Information System - SIAB

Table 3 - Households without sanitary sewage in the macro-regions of Maranhão, in December 2014 and in the period from June to December 2015.

| Health macro-region | No. of families | FR% |
|---|---|---|
| South Macro-region | 300.182 | 14,57 |
| North Macro-region | 1.153.081 | 55,98 |
| Eastern Macro-region | 606.478 | 29,44 |
| Total | 2.059.741 | 99,99 |

Source: Ministry of Health - Primary Care Information System - SIAB

A disease that is directly related to the absence of sanitary sewage and has contact with contaminated water as a form of transmission is schistosomiasis (SOUZA,

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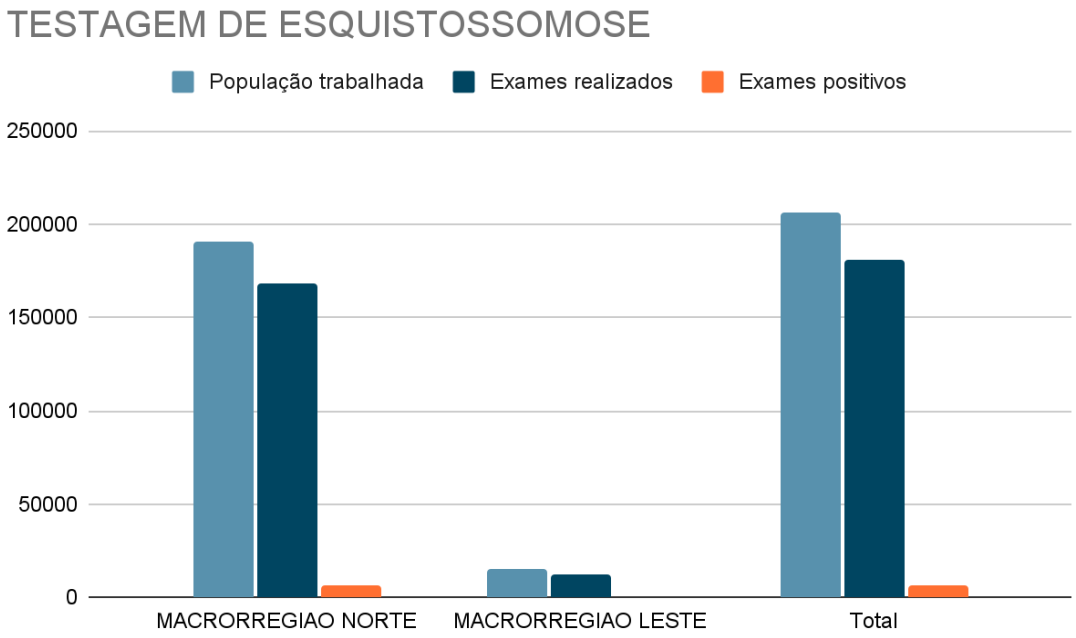
2021). In this scenario, data on schistosomiasis mansoni infection (graph and table 1) from 2014 to 2017, with no records from the southern macro-region in the database, show that the northern region leads with 6,111 tests that tested positive for the infection, out of 168,242 tests performed in a population of 190,592 people. While the eastern region has 76 positive tests, out of 12,571 tests carried out in a studied population of 15,172. Thus, the north and east have percentages of 3.63% and 0.6% of tests carried out that tested positive for schistosomiasis, respectively.

Graph 1 - Population worked, tests performed and positive tests by health macro-region in Maranhão, from 2014 to 2017.




In addition, it is possible to verify that in the northern macro-region the number of families without sanitary sewage is 4 times higher than the number of families that have sanitary sewage, while in the east this number is 10 times higher (table 4).

Table 4 - Comparison between households without sanitary sewage and with sanitary sewage (ignoring households with septic tanks) in the north and east macro-regions in December 2014 and in the period from June to December 2015.

| Health macro-region | Number of families without exhaustion *(FR%)* | Number of families with exhaustion *(FR%)* |
|---|---|---|
| South Macro-region | 300.182 (14,57) | 123.612 (26,46) |

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| | | |
|---|---|---|
| North Macro-region | 1.153.081 (55,98) | 285.114 (61,03) |
| Eastern Macro-region | 606.478 (28,44) | 58.441 (12,51) |
| Total | 2.059.741 (99.99) | 467.167 (100) |

Source: Ministry of Health - Primary Care Information System - SIAB

In addition, data regarding hospitalization for infectious diseases - such as intestinal infectious diseases, zoonotic bacterial diseases, arbovirus fevers and protozoans - in the macro-regions of Maranhão were also analyzed. The northern macro-region contains the highest number of hospitalizations in the period under analysis (2015-2017), followed by the eastern macro-region and, finally, the south. The data can be better visualized in Table 5, Table 6 and Graph 2, and are in line with what has already been presented in this study, since the indicators of basic sanitation are proportional to the indicators of infections, that is, in the regions with adequate sanitation (Tables 7, 8 and Graph 3), that is, in the regions with adequate sanitation (Tables 7, 8 and Graph 3), that is, fewer people exposed to open garbage or absence of sanitary sewage, there is a trend towards a reduction in the numbers of infectious diseases.

Another disease that has a sanitary deficit as a means of transmission is amoebiasis, which is a parasitic infection (ALMEIDA, 2020). Under the aforementioned disease, there is an analysis of graph 4, in which it is possible to note the southern macro-region with the lowest rates of hospitalization for amebiasis and that the eastern region, in the first two years of the analysis period, leads with the worst numbers. While the northern region surpasses the east in the last three years of the analysis period, and in 2017 there is a drastic difference between both regions, but they continue to be the regions with the highest incidence of amoebiasis.

Table 5 - Hospitalizations due to infectious and parasitic diseases by year according to the health macro-regions in Maranhão, from 2014 to 2017.

| Health Macro-region | 2014 | 2015 | 2016 | 2017 | TOTAL |
|---|---|---|---|---|---|
| South Macro-region | 14.840 | 13.921 | 14.553 | 13.486 | 56.706 |
| North Macro-region | 33.388 | 32.884 | 34.624 | 31.734 | 132.759 |
| Eastern Macro-region | 18.646 | 17.945 | 22.407 | 19.601 | 78.421 |

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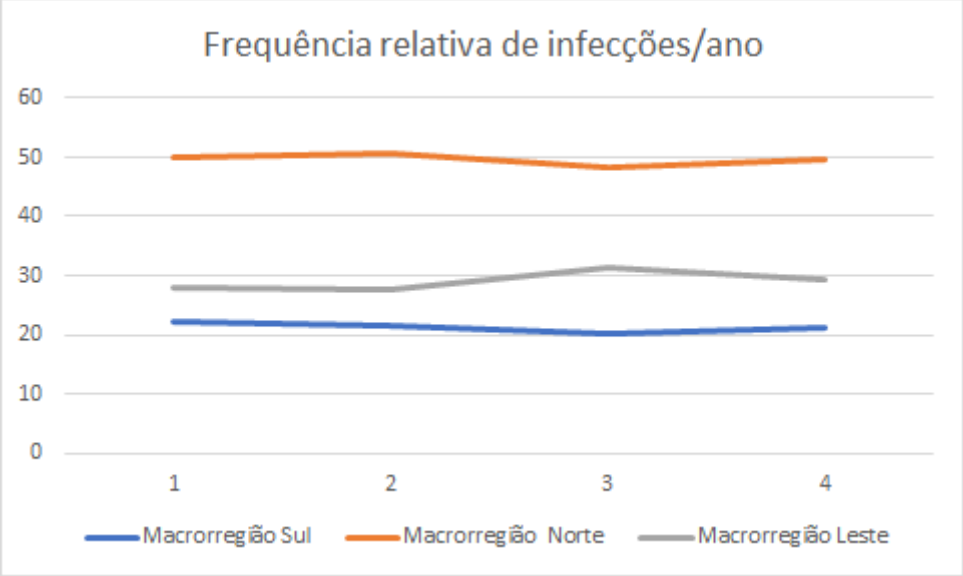
| | | | | | |
|---|---|---|---|---|---|
| TOTAL | 66.874 | 64.750 | 71.584 | 64.821 | 267.886 |

Source: Ministry of Health - Primary Care Information System - SIAB

Table 6 - Relative frequency (%) of hospitalizations due to infectious and parasitic diseases per year, according to the health macro-regions of Maranhão, from 2014 to 2017.

| Health Macro-region | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| South Macro-region | 22,19 | 21,5 | 20,33 | 21,14 |
| North Macro-region | 49,93 | 50,8 | 48,37 | 49,56 |
| Eastern Macro-region | 27,88 | 27,7 | 31,3 | 29,3 |

Graph 2 - Relative frequency (%) of hospitalizations due to infectious and parasitic diseases by year, according to the health macro-regions in Maranhão, from 2014 to 2017.




Legend: 1=2014, 2=2015, 3=2016, 4=2017.
Source: Ministry of Health - Primary Care Information System - SIAB

According to graph 2 and table 6, it is possible to verify the frequency in the number of hospitalizations due to infectious and parasitic diseases between the years 2014 and 2017. Thus, throughout the period of analysis, the highest relative frequency was in the northern macro-region, with an increase from 2014 (49.93%) to 2015 (50.8%), a slight decrease from 2015 to 2016 (48.37%), and a small increase from 2016 to 2017 (49.56%), in general, it remained high in relation to the other regions. The eastern macro-region is in the second position with the highest relative frequencies, and the southern region shows

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lower numbers of hospitalizations for infectious and parasitic diseases than the other regions during the entire period under analysis.

Table 7 - Sanitation situation, number of families, open garbage by year according to the health macro-regions in Maranhão, from December 2014 to December 2015.

| Health Macro-region | DEC/2014 *(FR%)* | DEC/2015 *(FR%)* | TOTAL *(FR%)* |
|---|---|---|---|
| South Macro-region | 40,798 *(14.2)* | 33,102 *(13.62)* | 73,900 *(13.93)* |
| North Macro-region | 156,544 *(54.48)* | 138,324 *(56.92)* | 294,868 *(55.6)* |
| Eastern Macro-region | 89,979 *(31.32)* | 71,592 *(29.46)* | 161,571 *(30.46)* |
| TOTAL | 287,321 *(100)* | 243,018 *(100)* | 530,339 *(100)* |

Source: Ministry of Health - Primary Care Information System - SIAB

Table 8 - Sanitation Situation, number of households with garbage collected per year according to the health macro-regions in Maranhão, from December 2014 and June to December 2015.

| Health Macro-region | DEC/2014 *(FR%)* | DEC/2015 *(FR%)* | TOTAL *(FR%)* |
|---|---|---|---|
| South Macro-region | 168,910 *(28.85)* | 143,459 *(30.73)* | 312,369 *(29.69)* |
| North Macro-region | 258,231 *(44.11)* | 202,226 *(43.32)* | 460,457 *(43.76)* |
| Eastern Macro-region | 158.225 *(27.03)* | 121,147 *(25.95)* | 279,372 *(26.55)* |
| TOTAL | 585,366 *(100)* | 466,832 *(100)* | 1,052,198 *(100)* |

Source: Ministry of Health - Primary Care Information System - SIAB

According to the last two tables (tables 7 and 8) and graph 3, we can see that the northern macro-region is both the one with the largest number of families subject to the use of garbage in the open, and the one with the largest number of families that have adequate basic sanitation and receive garbage collection. In this scenario, one factor does not cancel out the other, since, by a simple analogy, the greater the possibility of contact with disease vectors, the greater the chance of acquiring infections. Thus, the same thought can be

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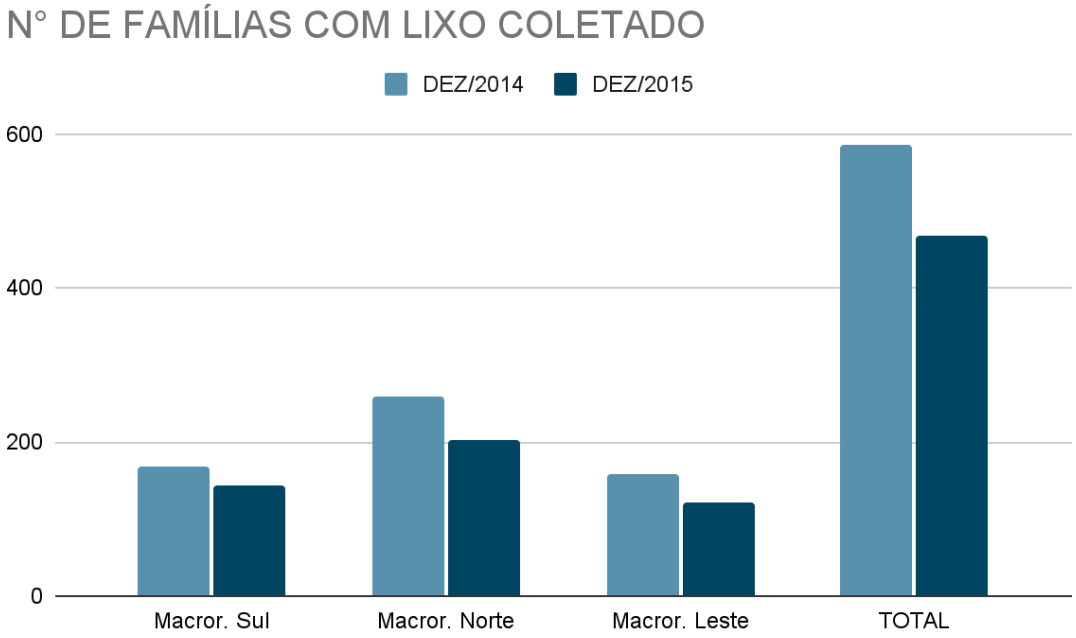
applied to the eastern and southern health macro-regions that have lower numbers of people exposed to open garbage and have lower relative frequencies throughout the analysis period (Table 7 and Graph 2).

Graph 3 - Sanitation Situation, number of families (in thousands) with garbage collected per year according to the health macro-regions in Maranhão, from December 2014 to December 2015.




Source: Ministry of Health - Primary Care Information System - SIAB

Graph 4 - Hospital admissions due to amebiasis in health macro-regions of the state of Maranhão, by year, from 2014 to 2017.

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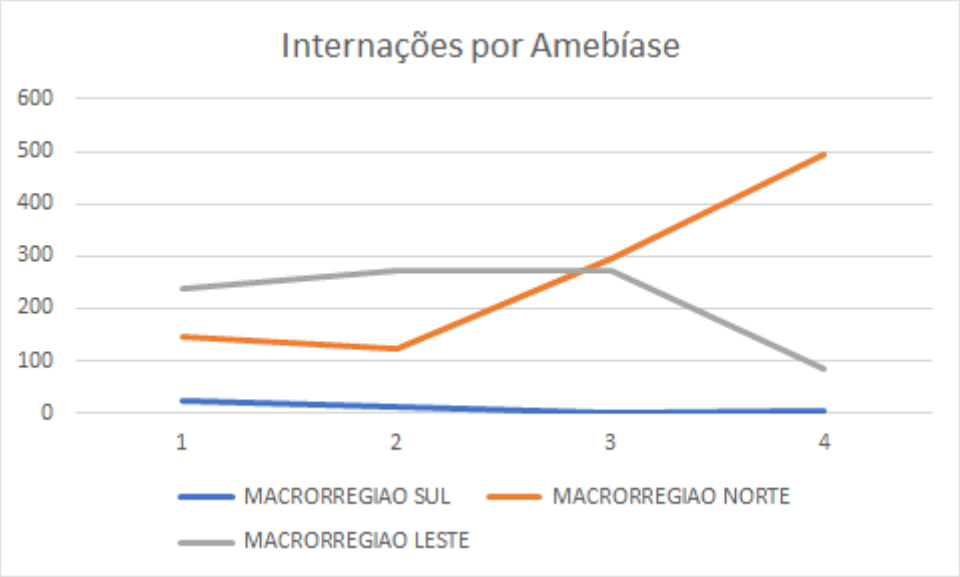


Legend: 1=2014, 2=2015, 3=2016, 4=2017.
Source: Ministry of Health - Primary Care Information System - SIAB

## CONCLUSION

Through this study, it can be concluded that exposure to inadequate basic sanitation is a determining factor for contamination by infectious diseases, since their transmission occurs through the absence of basic hygiene measures. Following this parameter, from the data presented, it is noted that the Macro-regions of Maranhão, used in the present study, present proportional values with regard to exposure to inadequate basic sanitation and the incidence of infections. Therefore, the two factors in question are integrally related.

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