

BASIC SANITATION INDICATORS IN MUNICIPALITIES IN THE MESOREGIONS OF THE STATE OF PARÁ

1 INTRODUCTION

Law No. 11,445/2007 defines sanitation as a set of services, infrastructure, and operational facilities for water supply, sanitary sewage, urban cleaning, solid waste management, and urban stormwater drainage (BRAZIL, 2007). The new basic sanitation framework, Law No. 14,026/2020, established a legislative structure to ensure universal access to sanitation services (BRAZIL, 2020).

According to data from the National Sanitation Information System (SNIS), in 2016, more than 100 million Brazilians did not have access to sewage services, and approximately 30 million still did not have access to drinking water (BRAZIL, 2018).

In the state of Pará, the capital, Belém, ranks 93rd in the Basic Sanitation Ranking of the Trata Brasil Institute 2024, facing problems with water supply, urban solid waste management, and an ineffective drainage system (INSTITUTO TRATA BRASIL, 2024). The management of basic sanitation indicators is essential for assessing the population's level of access to these essential services (TEODORO *et al.*, 2022).

In this context, this study aimed to analyze basic sanitation services based on indicators from 2017 to 2021 in the four most populous municipalities of four mesoregions in the state of Pará: Santarém, Belém, Altamira, and Marabá.

2 BASIC SANITATION AND LEGISLATION

The 1988 Constitution guarantees basic sanitation as a right, with joint responsibility for promoting improvements shared between the federal government, states, the Federal District, and municipalities (BRAZIL, 1988). Santos *et al.* (2018) state that, after Lula took office as president in 2003, there were important advances with the creation of institutions, programs, and legislation focused on the sanitation sector, such as the creation of the Ministry of Cities (2003), the Public Consortiums Law (Law 11,107/2005), and Public-Private Partnerships.

In addition, the new regulatory framework for basic sanitation was established by Law No. 14,026/2020, which updated Law No. 11,445/2007, and in its Article 3, item I, defined basic sanitation as the set of the following services:

- a) drinking water supply: consisting of the activities provision and maintenance of infrastructure and operational facilities necessary for the public supply of drinking water, from collection to building connections and their measuring instruments;
- b) sanitary sewage: consisting of the activities, provision and maintenance of the infrastructure and operational facilities necessary for the collection, transport, treatment, and final disposal of sanitary sewage, from building connections to its final destination for the production of reused water or its proper discharge into the environment;
- c) urban cleaning and solid waste management: consisting of activities and the provision and maintenance of infrastructure and operational facilities for collection, manual and mechanized sweeping, urban cleaning and maintenance, transportation, transfer, treatment, and environmentally appropriate final disposal of household solid waste and urban cleaning waste; and
- d) urban stormwater drainage and management: consisting of activities, infrastructure, and operational facilities for stormwater drainage, transport, detention, or retention to mitigate flood flows, treatment, and final disposal of drained stormwater, including cleaning and preventive inspection of networks. (BRAZIL, Law No. 14,026/2020, Art. 3).

Based on the definition of the aforementioned law, the National Basic Sanitation Plan (Plansab) was created, establishing integrated planning for the four components of basic sanitation, with a 20-year horizon, from 2014 to 2033 (BRAZIL, 2014).

Despite these advances, there are still significant variations in water supply and sewage services between regions. Coverage levels still show a long way to go, with 84.92% in water supply, 60.73% in sewage collection, and only 52.26% in the treatment of the effluent generated (SNIS, 2023).

2.2 BASIC SANITATION INDICATORS

Indicators are sets of data or variables that, when subjected to statistical operations, simplify meaningful information and facilitate the analysis of phenomena (PIMENTEL; CELLA, 2023).

Pimentel and Miterhof (2022) concluded that indicators can be used to expose the quality of services provided by operators and as necessary tools for improvement in planning and management of these services.

2.3 BASIC SANITATION AND THE STATE OF PARÁ

In Pará, Ordinary Law No. 7,731/2013 provides a basic sanitation policy, regulating planning, investments, service provision, regulation, and social control (PARÁ, 2013). The state government has been dedicated to improving access to water and sewage, investing and developing actions in partnership with sanitation management agencies. However, the state of Pará is still far below universalization standards. According to SNIS (2022), only 55.42% of the population has access to treated water, and only 9.24% is served by sanitary sewage. According to Marques, Gutjahr, and Braga (2021), the socioeconomic and environmental problems resulting from disorderly occupation in the outskirts of cities are possibly linked to the reality of poverty and lack of access to land.

3 METHODOLOGY

3.1 STUDY AREA

The study was conducted in the state of Pará, located in northern Brazil, with a land area of 1,245,870.704 km² and an estimated population of 8,116,132 people (IBGE, 2023). The state comprises 144 municipalities grouped into six mesoregions. For the study, four municipalities were selected, which are the most populous in their respective mesoregions: Santarém (Lower Amazonas Paraense), Belém (Metropolitan Region), Altamira (Southwest of Pará), and Marabá (Southeast of Pará).

3.2 RESEARCH CHARACTERIZATION (type of research, data collection, and analysis)

The research has characteristics of descriptive study. A descriptive study is designed to gain an accurate profile of events, persons or situations (SAUNDERS; LEWIS; THORNHILL, 2023). Descriptive surveys provide a description of a phenomenon in terms of the distribution of relevant variables within a particular population either at a single point in time (cross-sectional) or comparatively over time (longitudinal) by using repeat surveys (ROSE; SPINKS; CANHOTO, 2024). In this study, the analysis was focused on basic sanitation services, based on indicators for the period from 2017 to 2021, in four municipalities in the state of Pará.

Information was collected through bibliographic and documentary research, using scientific articles published in Qualis journals and academic websites.

Data was collected from National Sanitation Information System (SNIS). Data were selected from operational indicators for water, sewage, household and public solid waste collection, infrastructure, operations, and stormwater risk management. Data were collected from 2017 to 2021.

For the discussion and qualitative analysis of the data, graphs were constructed to visualize the results and critically analyze the basic sanitation conditions in the municipalities covered by this study.

3.3 DESCRIPTION OF INDICATORS

Frame 1 presents and describes the nine indicators selected for this study, covering the four components of basic sanitation:

Frame 1 - Description of the selected basic sanitation indicators

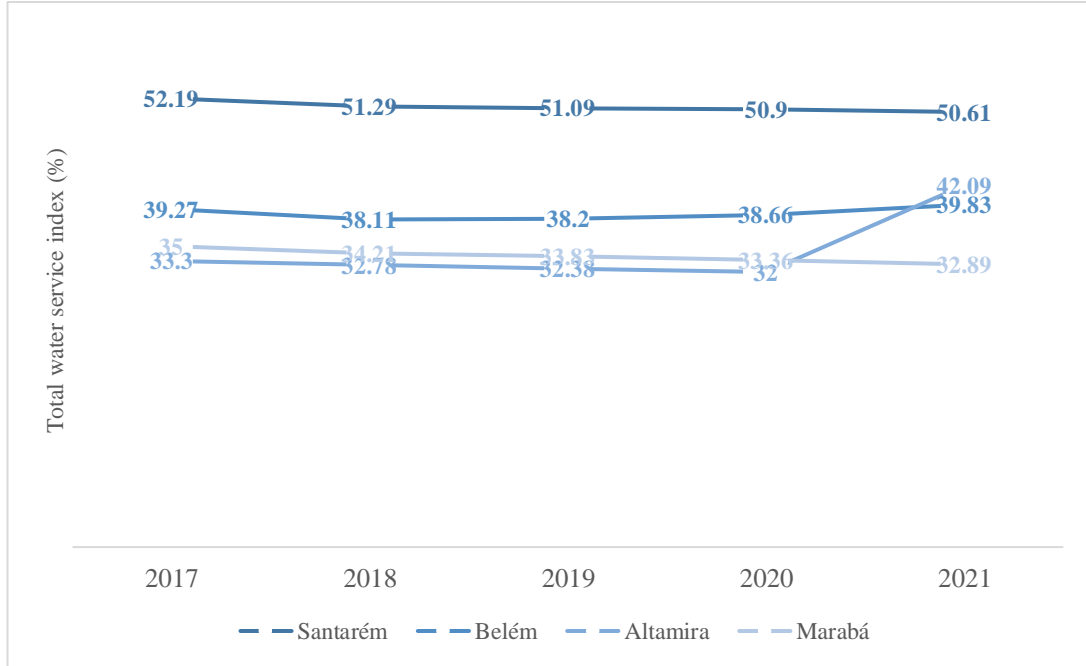
Area	Code	Indicator	Description
Water supply	IN055	Total water service index	Measures the proportion of the population served by public water networks.
	IN022	Average per capita water consumption	Monitors average water consumption, which is essential for operational control and planning.
Sanitary waste disposal	IN015	Sewage collection index	Represents the coverage of sewage collection services in relation to the total population.
	IN016	Sewage collection index	It indicates the proportion of the volume of sewage collected that is treated.
	IN056	Total sewerage service coverage index	Calculates the proportion of the population served by public sewage networks.
Solid waste management	IN014	Coverage rate of direct household collection services (door-to-door) for the urban population	Measures the proportion of the urban population that receives regular waste collection.
	IN015	Regular coverage rate of solid waste collection services in relation to the total population	Represents the proportion of the population (urban and rural) regularly served by solid waste collection.
Urban stormwater drainage and management	IN040	Percentage of households at risk of flooding	Quantifies households in areas susceptible to flooding.
	IN041	Percentage of population impacted by hydrological events	Assesses the proportion of inhabitants affected by phenomena such as floods and droughts.

Source: authors (2025).

4 RESULTS AND DISCUSSION

For water supply services, the indicators analyzed were the Total Water Service Index (Figure 1) and Average Per Capita Water Consumption.

Figure 1 – Total water service index (%) in the municipalities of Santarém, Belém, Altamira, and Marabá.



Source: authors (2025).

None of the municipalities analyzed reached the national average (84.2%) or the average for the North region (60%) for total water supply, showing a significant gap in relation to other areas of the country. The Plansab targets (95% for 2023 and 99% for 2033) are far from those municipalities. The lack of investment in the North region results in higher public health expenditures (ROSSONI *et al.*, 2020).

Significant disparities exist in terms of sewage. Santarém showed gradual growth, but at low rates (12.29% in 2021). Belém recorded fluctuations and a decline in 2020. Altamira stood out with more than 80% collection and 100% treatment, whereas Marabá obtained the worst results, despite the installation of a station in 2017.

The traditional collection model prevails for solid waste management services in Pará, generally without selectivity. Selective collection occurs in larger cities, conducted by cooperatives and waste pickers (GONÇALVES *et al.*, 2020). Santarém and Altamira maintained 100% urban coverage, while Belém and Marabá fluctuated but remained close to universal coverage. Marabá was the only city to reduce its RDO coverage (from 90.88% in 2018 to 86.91% in 2021).

For urban stormwater management services, Altamira achieved the best results, with no significant reports of at-risk households. Marabá reduced its figures from 33.1% (2017) to 0.6% (2018) but saw an increase in the affected population in 2020 (9.2%). The service remains one of the most fragile aspects of sanitation, marked by insufficient resources and institutional capacity (BAUM; GOLDENFUM, 2021; BORGES *et al.*, 2022).

5 CONCLUSION

The results show significant inequalities in access to basic sanitation between Santarém, Belém, Altamira, and Marabá, with Altamira performing significantly better than Santarém and Marabá. The persistence of inadequate infrastructure and lack of investment compromises public health, quality of life, and the environment of the region. Thus, it is essential to implement effective public policies and continuous investments to universalize access to drinking water, sewage, and urban drainage services, thereby contributing to the sustainable development of the region.

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