JOURNAL OF ENVIRONMENTAL MANAGEMENT & SUSTAINABILITY

REVISTA DE GESTÃO AMBIENTAL E SUSTENTABILIDADE – GeAS

Received: 17 June 2021 - **Approved:** 30 Aug. 2022
Responsible editor: Andreza Portella Ribeiro
Associate Editor: Donizete Beck
Evaluation Process: Double Blind Review
https://doi.org/10.5585/geas.v11i1.20281
e-ISSN: 2316-9834

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Access and quality of provision of sanitation services in a coastal city of the state of São Paulo: study of a neighborhood's perception in the city of Guarujá

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Cite as - American Psychological Association (APA)

Lima, R. S., Marotti, A. C. B., Santiago, C. D., Pugliesi, E., & Moschini, L. E. (2022). Access and quality of provision of sanitation services in a coastal city of the state of São Paulo: study of a neighborhood's perception in the city of Guarujá. *Rev. Gest. Ambient. e Sust. - GeAS.*, *11*(1), 1-30, e20281. https://doi.org/10.5585/geas.v1i1.20281

ABSTRACT

Objective: To assess the perception of the inhabitants of the Santa Rosa neighborhood (Guarujá-SP) on the provision of basic sanitation services and to identify demands and priorities for improving these services.
Methodology: To identify the demands, structured questionnaires were applied in groupings of blocks, defined based on the social development index, in order to consider the socio-environmental complexity of the neighborhood. The results were spatialized to assess possible differences in perception between the different neighborhoods that make up the study area.
Relevance: Basic sanitation is an essential human right, and the universalization of these services is one of the great contemporary challenges, due to its complexity. Despite the universalization and quality of services being of interest to various social actors, the policies adopted do not always reflect the needs of society.
Results: A high degree of heterogeneity was observed in the perception in terms of service provision and quality in the neighborhood. Water supply is the only service assessed as adequate; on the other hand, drainage and sanitation are the ones that most require improvements, while waste management has a very different perception compared to the available data. These results reveal the importance of social participation in all stages of basic sanitation management. Incorporating participation results in policies that reflect and address the real demands of the population.
Management contributions: Priority areas for investments and improvements were identified to improve services and the quality of life of the local population. The results can also contribute to the updating of municipal plans and/or regulations.

Keywords: geoprocessing; environmental perception; basic sanitation services; public policy.

Acesso e qualidade da prestação dos serviços de saneamento básico: percepção de uma população no litoral paulista, município de Guarujá

RESUMO

Objetivo: Avaliar a percepção dos habitantes do abairramento Santa Rosa (Guarujá-SP) sobre a prestação de serviços de saneamento básico e identificar demandas e prioridades para melhoria desses serviços.
Metodologia: Para a identificação das demandas foram aplicados questionários estruturados em agrupamentos de quarteirões, definidos com base no índice de desenvolvimento social, a fim de considerar a complexidade socioambiental do abairramento. Os resultados foram espacializados para avaliar possíveis diferenças de percepção entre os diferentes bairros que compõe a área de estudo.
Relevância: O saneamento básico constitui um direito humano essencial, e a universalização destes serviços é um dos grandes desafios contemporâneos, devido a sua complexidade. Apesar da universalização e qualidade dos serviços serem de interesse de diversos atores sociais, nem sempre as políticas adotadas refletem as necessidades da sociedade.
Resultados: Observou-se elevada heterogeneidade na percepção quanto ao atendimento e à qualidade dos serviços de saneamento básico no abairramento. O abastecimento de água é o único serviço avaliado como adequado; por outro lado, drenagem e esgotamento sanitário são os que mais demandam melhorias, enquanto a gestão de resíduos tem uma percepção bastante distinta dos dados disponíveis sobre atendimento. Estes resultados revelam a importância da participação social em todas as etapas da gestão do saneamento básico. Incorporar a participação resulta em políticas que refletem e contemplam as demandas reais da população.
Contribuições para a gestão: Foram identificadas áreas prioritárias para investimentos e aprimoramentos, objetivando a melhoria dos serviços e da qualidade de vida da população local. Os resultados também podem contribuir para a atualização de planos e/ou normativas municipais.

Palavras-chave: geoprocessamento; percepção ambiental; saneamento básico; políticas públicas.

Acceso y calidad de la prestación de servicios básicos de saneamiento: percepción de una población de una ciudad de la costa de São Paulo, municipio de Guarujá

RESUMEN

Objetivo: Evaluar la percepción de los habitantes del barrio de Santa Rosa (Guarujá-SP) sobre la provisión de servicios de saneamiento básico e identificar demandas y prioridades para mejorar esos servicios.
Metodología: Para identificar las demandas, se aplicaron cuestionarios estructurados en agrupaciones de manzanas, definidas a partir del índice de desarrollo social, a fin de considerar la complejidad socioambiental del barrio. Los resultados se espacializaron para evaluar posibles diferencias de percepción entre los distintos barrios que conforman el área de estudio.
Relevancia: El saneamiento básico es un derecho humano fundamental, y la universalización de estos servicios es uno de los grandes desafíos contemporáneos, por su complejidad. A pesar de que la universalización y la calidad de los servicios interesan a diversos actores sociales, las políticas adoptadas no siempre reflejan las necesidades de la sociedad.
Resultados: Se observó un alto grado de heterogeneidad en la percepción del servicio y la calidad de los servicios de saneamiento básico en el barrio. El suministro de agua es el único servicio evaluado como adecuado; por otro lado, el drenaje y alcantarillado sanitario son los que más requieren mejoras, mientras que la gestión de residuos tiene una percepción muy diferente de los datos disponibles sobre el servicio. Estos resultados revelan la importancia de la participación social en todas las etapas de la gestión del saneamiento básico. Incorporar participación en políticas resulta que las mismas reflejen y atiendan las demandas reales de la población.
Contribuciones de la gestión: Se identificaron áreas prioritarias para inversiones y mejoras, con el objetivo de mejorar los servicios y la calidad de vida de la población local. Los resultados también pueden contribuir a la actualización de los planes y/o reglamentos municipales.

Palabras-clave: geoprocesamiento; percepción ambiental; saneamiento básico; políticas públicas.

Introduction

Basic sanitation services are structured from four components: drinking water supply; sanitation - including both collection and treatment; public cleaning and solid waste management; as well as rainwater drainage and management (Law 11,445/2007, Law 14,026/2020). The UN/United Nations declared in 2010 that access to water and sanitation constitutes one of the essential human rights and also one of the main means of protection of the quality of water resources, promoting improvements in the relevant environmental conditions for the maintenance of the public health (Ribeiro Ayachi et al., 2012). Thus, the universalization of the water supply network, sewage collection and treatment can be considered as global parameters of quality of life (UN, 2000; UN, 2010; IBGE, 2011).

Although being essential, the basic sanitation services universalization is presented as one of the biggest challenges today as well as being one of the main themes about the well-being in the urban environment (Gandelman et al., 2012; Dodman et al., 2013). Part of this challenge lies in the multidisciplinarity of the basic sanitation which demands an integrated approach to the different knowledge fields and the players involved, notably the civil society, public authorities, universities, and the business and industrial sectors (IBGE, 2011; Ribeiro Ayachi et al., 2012; Dodman et al., 2013; Crumpton et al., 2021).

The Brazilian reality in the basic sanitation sector is characterized by geographic disparities in the access of the population to the services (Leoneti et al., 2011; Borja, 2014), the southeastern region being the one that presents the most satisfactory figures. In this region, e.g., there are approximately 1.2 million people (2.6% of the population of the region) without access to adequate water supply services. In the meantime, in the northern region this service deficit reaches 7.7 million inhabitants (14.4% of the population of the region) (IBGE, 2010). In this regard, Godoy (2013) points out that the basic sanitation is heterogeneous and deficitary in the country where the regional contrasts are consequences of the federal political-administrative organization.

In the legislative field, the national legal framework which regulates the basic sanitation in the country is the LNSB/*Lei Nacional de Saneamento Básico* (Basic Sanitation National Law, in a free translation) instituted by Law 11,445/2007 and updated by Law 14,026/2020. The LNSB was conceived aiming to embed ways of institutional organization covered by the basic sanitation consistent with the multiple social, environmental and economic realities present in a country of continental dimensions such as Brazil (Law 11,445/2007; Leoneti et al., 2011). In this context, the basic sanitation plans are an important tool present in the LNSB (Law 11,445/2007; Law 12,305/2010) that must promote the participation of the set of several groups interested in this theme such as technicians, the civil society, service providers, among others.

At the federal level, Plansab/*Plano Nacional de Saneamento Básico* (Basic Sanitation National Plan, in a free translation) was first published in 2013 resulting from a process of broad participation and based on a comprehensive study called Basic Sanitation Outlook in Brazil (free translation of *Panorama do Saneamento Básico no Brasil*) carried out jointly by several Brazilian universities. Covering a planning horizon up to 2033, goals were set in this plan, as well as investments, programs and actions to be taken by the federal government coming to the basic sanitation were estimated and assessed, considering as a guide not only the universalization of the services but also the national guidelines of the federal policy. Plansab has been under review and updating since 2018 (Brasil, 2011; Brasil, 2013; Brasil, 2022).

Analysing the latest data in SNIS/National System of Information on Sanitation (free translation of *Sistema Nacional de Informações sobre Saneamento*), it is shown that 84.1% of the Brazilian population is provided with water supply services, being such a coverage broader when only the urban population is considered (93.4%). Considering the sanitation component, 55% of the population and 63.2% of the urban population are served by collection, 50.8% of the sewage generated is treated, what corresponds to 79.8% of the sewage collected. Concerning solid waste, 90.5% of the population is served by household waste collection whereas 36.3% of the cities count on selective waste collection. For the three aforementioned components, the best regional indexes are found in the southeast of the country. Lastly, 57.3% of the Brazilian cities have drainage systems whereas 67.6% do not present mapped flood risk areas (SNIS, 2020[1]). Therefore, it is noticeable the presence of a scenario far from universalization.

The LNSB enactment intended to disrupt the state of inertia and omission observed in most Brazilian cities, being these the responsible ones entitled to provide basic sanitation services, together with their own providers due to the uneven distribution of investments for the expansion and improvement of the quality of services (Leoneti et al., 2011; Borja, 2014). In relation to the municipal management, it is observed that the elaboration and execution of public policies are seen as challenges that end up mostly resulting in initiatives with either little applicability or popular acceptance with few effective benefits concerning the spatio-temporal scale directly affecting the quality of life of the population.

The municipal plans are important planning and management tools instituted by their respective national policies. The elaboration process of these documents must involve the several parties interested in these, including technical bodies, representatives of the municipal management and society (Siqueira, 2008; Latu, 2009; Ribeiro Ayachi et al., 2012; Freitas,

[1] The 2020 edition of the Diagnosis of Water and Sanitation Services had the participation of 5,350 municipalities in the water component (96.1% of the total) and 4,744 municipalities (85.2% of the total) for the sanitation component. In the case of Urban Solid Waste Management, 4,589 municipalities participated (82.4% of the total) and in the case of Drainage and Urban Stormwater Management, 4,107 municipalities participated (73.7% of the total) (SNIS, 2020).

2015), being a strategical tool for the participative planning and management (Law 11,445/2007). When instituted, such becomes the development reference for the city, setting up guidelines and goals for provision of services of basic sanitation (e.g., Ordinary Law 4,367/2016; Complementary Law 227/2018; Complementary Law 228/2018). The population awareness coming to the importance of these tools contributes for a broader participation and involvement in the basic sanitation planning (Ribeiro Ayachi et al., 2012) as well as in other public policies (Latu, 2009; Rodrigues et al., 2012; Freitas, 2015).

Guarujá City is located on the coast of São Paulo State in a metropolitan region called Baixada Santista. It has an estimated population of 324,977 inhabitants (IBGE, 2021). According to SNIS data, the city presents 82.57% of the population with access to the water supply services; 70.05% of population served by sewage collection; 100% of the urban population with household waste collection provision; and 45.3% of households in the city are at flood risk conditions (SNIS, 2020). This city has issued the second version of its Municipal Plan for Basic Sanitation instituted by the Complementary Law 228/2018. The first version was issued in 2010.

As aggravating difficulties for making the basic sanitation municipal public policies effective, it can be pointed out that these not always reflect the population expectations what is added to conflicts of interests that interfere in their formulation (Siqueira, 2008; Freitas, 2015) and to the distancing of managers responsible for decision-making. Thus, one of the aspects to be given greater attention in the search of solutions for the inefficiency of the public policies is valuing and guaranteeing room for opinions and social demands presentation, including the social participation in the elaboration process as recognized by the National Law which declares the social control as a fundamental principle for the provision of services (Scardua & Bursztyn, 2003; Marshall & Farahbaksh, 2013; Jana & Harata, 2016).

In this context, the social participation in the formulation of public policies looks for the incorporation of the popular interests and demands in the decision-making process (Freitas, 2015), defined from both the individual and collective perceptions of the urban realities (Rodrigues et al., 2012). The environmental perception is a comprehension process of the reality that covers the interrelationships between the human beings and the environment by means of sensory and interpretative mechanisms which influence their expectations, satisfactions, values and behaviors (Melazo, 2005; Ribeiro Ayachi et al., 2012; Rodrigues et al., 2012). Each individual and social group present different perceptions, reactions and responses to actions resulting from the environment according to their specific culture, life experience, values, biological specificities, among others (Melazo, 2005; Siqueira, 2008; Ribeiro Ayachi et al., 2012). Thus, environmental perception studies play a key role ensuring that decision-making actions take into consideration their interests and demands meeting their priority needs (Siqueira, 2008; Rodrigues et al., 2012; Freitas, 2015), contributing to the city

management for both the elaboration and effectiveness of the public policies.

By recognizing the complexity and difficulty of elaborating, applying and monitoring the public policies giving the due importance to the popular perception, GIS/Geographic Information Systems make possible a differentiated view of the data sets and structures, expanding the comprehension of today's conditions and the identification of alternatives for action (Latu, 2009). This way, GIS is a tool for the collection, storage, recovery, transformation, and representation of both spatial and non-spatial data (Farina, 2006; Latu, 2009) what allows a more adequate understanding of the relevant information making the due interpretations easier.

Allowing the data integration, the establishment of planning actions, supervision and monitoring of environmental and urban processes (Farina, 2006; Müller et al., 2002), GIS consist of an important decision-making tool, providing the knowledge of the spatial distribution of the demands of the population and their impacts on the public health conditions granting the application of the public resources in a more effective way (Müller et al., 2002; Latu, 2009).

Considering that the improvement and optimization of the public services provision have as prerequisite the knowledge of today's situation as well as its relationships with socio-environmental factors (Crispim et al., 2016) and also the perception of the population for the identification of the gaps and the opportunities of action (Rodrigues et al., 2012), this study has the objective of evaluating the perception on the basic sanitation services provision besides identifying the demands and priorities for the services betterment pointed out by the population of Santa Rosa neighborhood in Guarujá City in São Paulo.

This article is structured on the following sections: *(i) methodology*, which introduces the area of study, the strategies used for the definition of the target groups for the questionnaire as well as its structuring, application, and the format for the analysis of the results; *(ii) results and discussion*, where the target groups are spatialized and characterized considering their socio-economical profile, the coverage of the basic sanitation services, and further their perception on the basic sanitation services provision will be addressed and then the population demands related to this will be identified; and *(iii) final considerations*, for the article conclusion.

Methodology

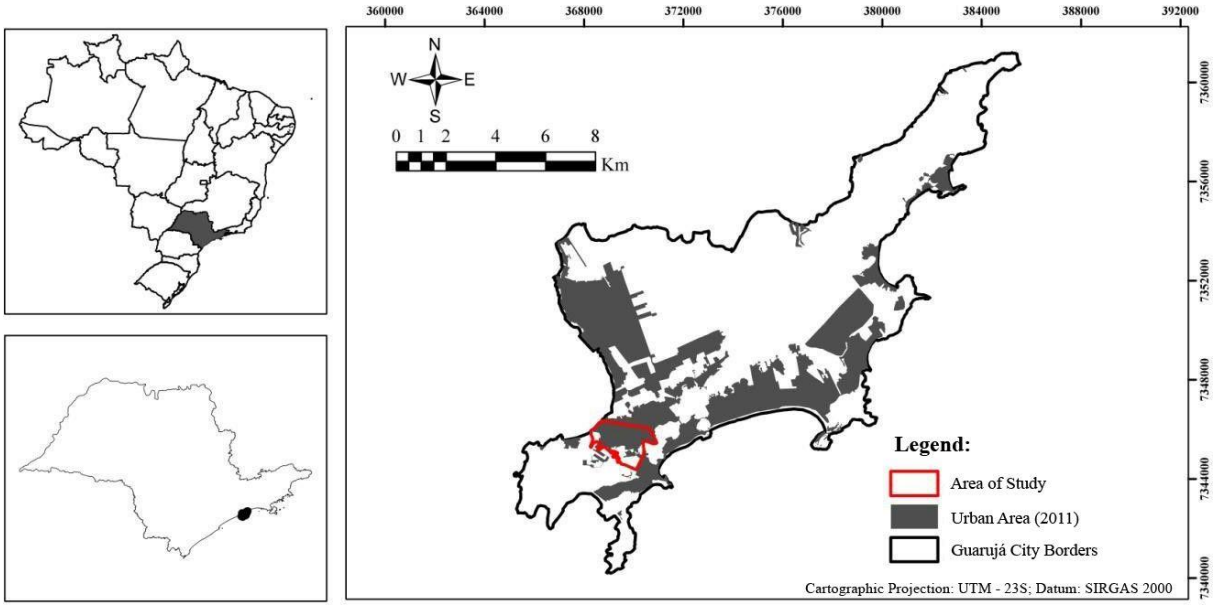
Area of Study

The area of study is located in the urban perimeter of Guarujá City in São Paulo State (Figure 1), comprising a 2.89 km^2 area and 2% of all the city territory. The city has an estimated population of 318,107 inhabitants (IBGE, 2021). Compared to 2010 when the last Demography Census was carried out, there has been a population growth of 11.8% throughout this period. The resident population in 2010 in this neighborhood was roughly 22,600 inhabitants, around

8% of the total population at the time, with a population density of 7,753.58 inhabitants/km^2 (IBGE, 2010). Bearing in mind that the local scale is the ideal one for the discussion of the needs and aspirations of the population as well as for the implementation of the public policies (Freitas, 2015), it has been decided to limit the study to a city region where the pertinent characteristics to this theme are present apart from being upheld by the Municipal Master Plan (Complementary Law 108/2007).

Figure 1

Guarujá City location in São Paulo State and Santa Rosa neighborhood limits



Note. Self-elaboration.

In this perspective, Santa Rosa neighborhood (i.e., a set of smaller neighborhoods) is inserted in Administrative Region 1 of Guarujá Master Plan (Complementary Law 108/2007). This region is characterized mainly by the presence of consolidated commercial and residential infrastructures. However, it is still possible to notice areas in need of urban restructuring in which it is necessary to complement and expand the urban infrastructure besides promoting a more efficient environmental control (Complementary Law 108/2007). The area of study was limited based on the census sectors of the 2010 Demography Census (IBGE, 2010) as well as on the Municipal Master Plan (Complementary Law 108/2007), encompassing the following smaller neighborhoods: Vila Lygia, Vila Santa Rosa, Jardim Helena Maria, and Jardim Las Palmas.

Group definition for the application of the questionnaires and definition of the sample size

In order to consider the socio-environmental complexity of the neighborhood and feasibility of the research development, it has been adopted the strategy of group definition for the application of the questionnaires which was performed based on the SDI/Social Development Index proposed by Cavallieri & Lopes (2008). SDI provides quantitative criteria for the comparison of the social development degree between different areas taking into consideration normalized values of service-related indicators in basic sanitation, among other aspects. For such, it uses the data from the Demography Census (IBGE, 2010) aggregated on the spatial scale of the census sectors.

Based on a factor analysis, Cavallieri & Lopes (2008) identified the most influential variables to describe the gradient of social development in Rio de Janeiro City quantifying, in this way, the weight for each one of them for the index composition. The indicators considered for the SDI calculation are found on Table 1 as well as the corresponding variables of the 2010 Demography Census (IBGE, 2010), besides the weighting coefficients for the index calculation.

Table 1

Variables of 2010 Demography Census used for the SDI calculation

SDI Indicator	2010 Census Variables	Weighting Coefficient
Percentage of households with adequate water supply service (with internal plumbing connected to the general network)	Domicilio01_UF: V012; Básico_UF: V001	0.141
Percentage of households with adequate sanitation service (connected to the general network)	Domicilio01_UF: V017; Básico_UF: V001	0.004
Percentage of households with adequate waste collection service	Domicilio01_UF: V035; Básico_UF: V001	0.223
Average number of bathrooms per person	Domicilio01_UF: V025 até V034; Básico_UF: V002	0.134
Percentage of illiteracy in people over 15 years old	Pessoa01_UF: V012 até V077; Pessoa13_UF: V049 até V134	0.036
Average monthly income of the household breadwinner in minimum wages	ResponsavelRenda_UF: V001 até V009; Básico_UF: V001	0.066
Percentage of household breadwinners with a monthly income of up to two minimum wages	ResponsavelRenda_UF: V001 até V003; Básico_UF: V001	0.167
Percentage of household breadwinners with a monthly income equal to or above ten minimum wages	ResponsavelRenda_UF: V007 até V009; Básico_UF: V001	0.021

Note. Adapted from Cavallieri & Lopes (2008) and IBGE (2010).

It is also noticeable that the index counts on other two indicators (percentage of household breadwinners with less than four years of education; and percentage of household breadwinners above 15 or over years of education) that were not used for the calculation application since they were not available when the research was carried out.

After the indicators calculation, a boxplot was used to determine the groups and afterwards for the questionnaire application. Two groups were defined from the extreme values: one with values above the data superior limits; the other one below the inferior limit. Then other five groups were defined based on equal intervals in relation to the remaining SDI values between the two limits mentioned.

Bearing in mind the relevance of knowing the situation of the basic sanitation service provision in the neighborhood, questionnaires were applied which made possible to identify the demands of each sampled study group as well as block. Initially, aiming the questionnaire application, the minimum quantity of these was calculated in order to gain the results within a preset interval, adopting the methodology by Oliveira & Grácio (2005). This way, the sample size for the questionnaire application was calculated based on the equation for simple random sampling (Equation 1):

$$n = \frac{(N.n')}{(N+n')} \quad (1)$$

Being n = the simple random sampling size; N = the population size considering the private households per group; $n' = 1/E_0^2$; and E_0= acceptable sampling error (a 12% error was adopted for the calculation in order to make the research viable). For such, it has been considered the number of households for the determination of the population size.

Based on this calculation, a minimum of 390 questionnaires was estimated for the neighborhood. The study groups, number of households of the group, as well as the number of questionnaires applied in the group are presented in Table 2. The minimum number calculated has not been applied in Group 7 (due to either the refusals to reply to it or the household being empty), and more questionnaires than the minimum quantity calculated were applied in Groups 2 and 5. The selection of the blocks for the questionnaires application was performed randomly.

Table 2

Number of households and questionnaires applied in the neighborhood in Guarujá City in São Paulo

Application Groups	Number of households in the group	Questionnaires applied
1	1,057	65
2	459	63
3	587	62
4	3,003	68
5	1,029	66
6	426	60
7	12	9
Total	**6,573**	**393**

Note. Self-elaboration.

Structuring and application of the questionnaires

The application of the questionnaires has been presented as a more viable method for the analysis of the civil society perception being such an extensive direct observation strategy. In order to know the perception of the population about the basic sanitation services in the neighborhood nine closed questions were elaborated with qualitative answers to be chosen from a previously determined set of alternatives (Freitas et al., 2000; Günther, 2003; Hill & Hill, 2008).

The questionnaire (Appendix I) went through a pre-test for improvement in neighborhood locations with an average flow of people being answered only by people who live in the area of study. After the pre-test validation, the questionnaire was applied and the answers were analysed quantitatively, seeking to identify demands and priorities in the basic sanitation management in the neighborhood. Complementarily, ArcGIS online geographic information system server software and services were used to represent and spatialize the results since the spatialization of urban-environmental information make possible the identification of patterns in the provision of services, occasional nonconformities, besides contributing for the comprehension of the demands of the population. Thus, the GIS application in studies on the perception of the population enables the composition of access scenarios and of the quality of the provision of the basic sanitation services helping in the decision-making processes.

Results and discussion

The results are presented and discussed in three sections. In the first section, the characterization of the area of study based on SDI is introduced, taking into consideration the spatial heterogeneity of the service provision and the selection of the groups for the questionnaire application. In the second section, the data collected from the questionnaires were spatialized and analysed. Lastly, in the third section, the demands and priorities of the population referring to the basic sanitation services provision were identified.

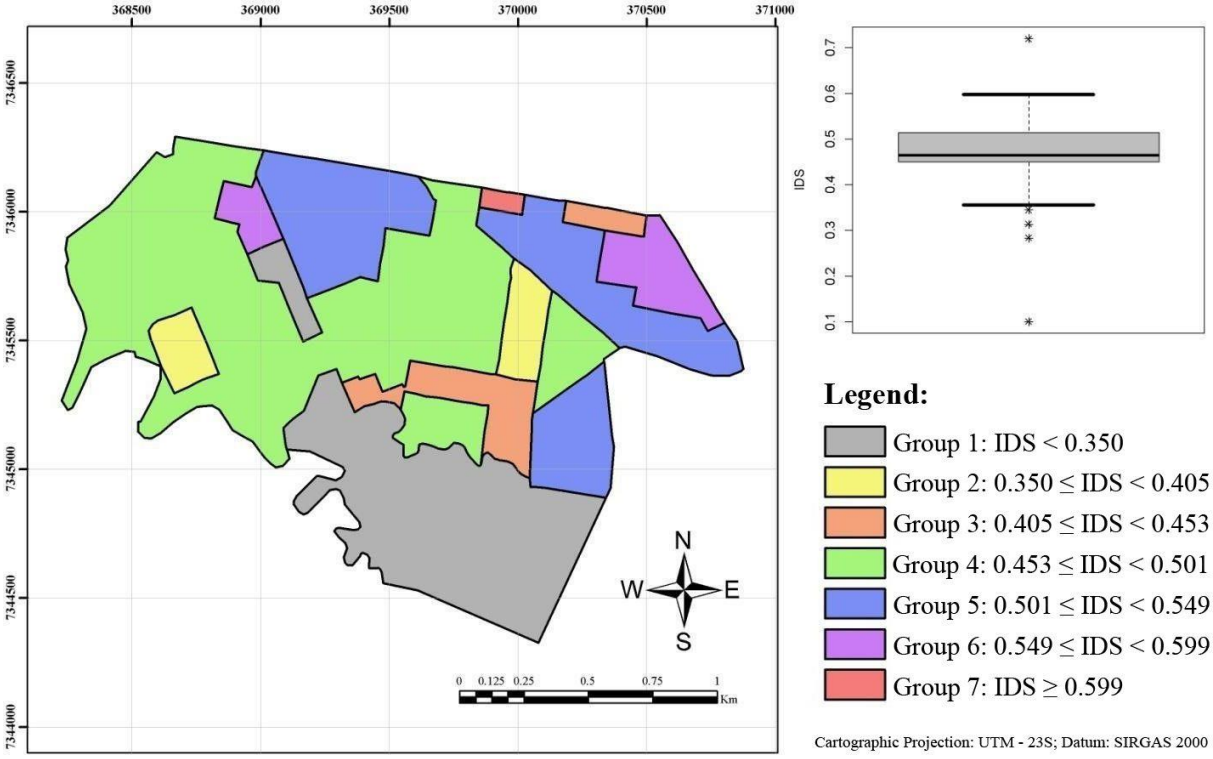
Characterization of the groups defined by the SDI

Based on the 2010 Demography Census data, it was made possible to obtain the SDI-associated value for the 32 census sectors which make up the neighborhood. The 2010 Demography Census data show the occurrence of a considerable heterogeneity on the coverage of the sanitation services as well as waste collection in the area of study. For instance, the coverage of the sanitation service varied between 11.8% and 100% in the census sectors, being such an index of 55.45% in the country. In contrast, the service of water supply was shown to be pretty homogenous among the sectors, varying from 90.3 to 100%. In the country, 82.85% of the households were covered by the general supply network in 2010. In that regard, it stands out the fact that 75% of the sectors inserted in the area of study have presented full coverage in their households, a considerably much better situation than the one observed in the country by the 2010 Census.

Based on these data, seven groups were identified for the application of the questionnaires (Figure 2). Thus, sectors with similar socioeconomic features were associated in the same group making the characterization of the service provision possible. Table 3 presents the average of the normalized values of each one of all the variables that make up the SDI for the study groups.

Figure 2

Mapping of the groups for the application of the questionnaires in the neighborhood in Guarujá City in São Paulo



Note. Self-elaboration.

Table 3

Average of the normalized values of the variables which make up SDI per study group (Cavallieri & Lopes, 2008), calculated from the 2010 Census data (IBGE, 2010)

Variables	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Water Supply	0.752	0.952	0.986	0.988	0.942	1.000	1.000
Sanitation	0.390	0.874	0.857	0.836	0.865	0.899	1.000
Waste Collection	0.182	0.592	1.000	1.000	1.000	1.000	1.000
Number of Bathrooms per Person	0.178	0.338	0.138	0.312	0.494	0.581	1.000
Illiteracy Among People older than 15	0.589	0.352	0.262	0.220	0.243	0.044	0.121
Monthly Income of the Household Breadwinners	0.393	0.517	0.274	0.518	0.835	0.795	0.480
Household Breadwinners with Income up to 2 Minimum Wages	0.555	0.247	0.694	0.357	0.139	0.191	0.555
Household Breadwinners with Income above 10 Minimum Wages	0.167	0.083	0.016	0.118	0.361	0.599	1.000

Note. Self-elaboration.

Thus, the variation of the normalized indicators of the basic sanitation services provision emphasizes the spatial heterogeneity of the quality of the basic sanitation services provided so that, even in a small scale, disparities can be observed in the neighborhood where one can find regions that are fully covered by the services while others count on a partial coverage (Table 3).

According to Table 3, Group 1 has presented the lowest indicator of waste collection service coverage as well as some of the lowest indexes of schooling and income when compared to the other groups. In studies carried out by Fereguetti & Santana (2002) and Franca et al. (2013), the direct relationship between the average income and the per capita generation of solid waste could be identified. However, it turns out that often the costs related to service provisions are not equally shared among the populations from different socioeconomical classes since lower-income populations tend to generate a lesser amount of waste when compared to the other social classes (Fereguetti & Santana, 2002; Franca et al., 2013). Thus, the demand for collection and transportation services in these places is reduced. Nonetheless, the tax usually charged for this service is the same charged in higher income areas where there is naturally a higher generation of waste (Fereguetti & Santana, 2002). From this perspective, it is expected that the groups with a lower income average and a higher percentage of household breadwinners with an income inferior to two minimum wages to be more prone to the negative effects of inadequate solid waste management.

Perception of the basic sanitation services provision

The results are presented and discussed in five related sets based on the services that make up the basic sanitation: (1) water supply; (2) sanitation; (3) urban drainage; (4) solid waste management; (5) issues involving municipal plans.

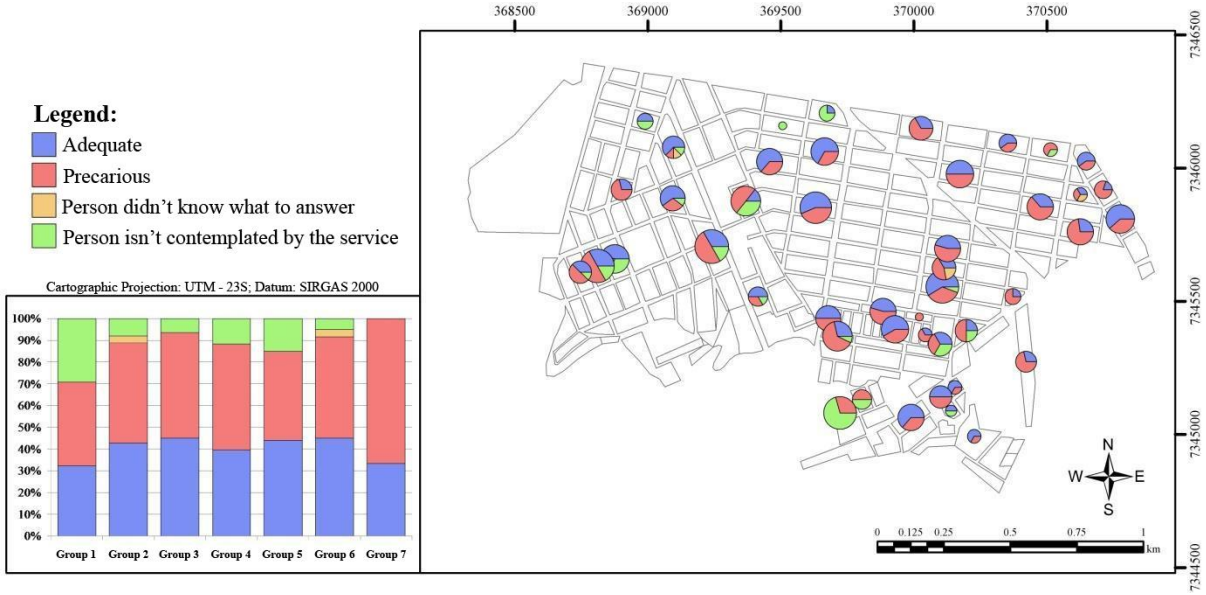
The water supply was considered suitable in all groups. However, a small share of the respondents declared not being contemplated by this service. The positive perception about the quality of this service may be the result of the higher investment this service usually receives compared to the other ones (Leoneti et al., 2011; Borja, 2014). On the other hand, the existence of households not served indicates the need for expansion of the water supply network for this population, bearing in mind that this shortage in the water supply service brings out impacts on both life and environmental quality (Tucci, 2002; Crispim et al., 2016). Such an expansion enables a cost reduction mainly in the public health area.

Contrasting the water supply, a big share of the population considered sanitation as being precarious (Figure 3), except Group 5 that mostly considered the service as being adequate. Besides this, most of the groups presented households with the provision of this service. Considerable portions of Groups 1 (29.2%), 4 (11.8%), and 5 (15.2%) declared not

being contemplated by this service (Figure 3).

Figure 3

Graphic and spatial representation of the situation of the provision of sanitation service per study group in the neighborhood in Guarujá City in São Paulo



Note. Self-elaboration.

Areas without sanitation provision coverage and with high levels of population density may be the result of spontaneous and non-planned growth of the urban occupation in the neighborhood. This results in a municipal inability in providing this service in suitable quantity and quality to the population, promoting the formation of population concentrations in unsuitable health and sanitation conditions (Tucci, 2002; Crispim et al., 2016). In the current version of the Municipal Basic Sanitation Plan (Complementary Law 228/2018), the expansion of the provision for irregular areas in the city was incorporated to the planning. The previous version (Guarujá, 2010) made it impossible the supply of services for the population residing in these areas due to legal restrictions. Thus, the expansion of the service for the populations residing in irregular areas in the neighborhood as well as in the city may affect, in a positive way, the coverage index of these services, considering the goal to serve 84% of the households up to 2020 and 95% up to 2032 (Complementary Law 228/2018).

Moreover, Gandelman et al. (2012) checked that the implantation of sewage collection systems is able to positively affect the degree of satisfaction of the populations coming to public health. Thus, the planning of basic sanitation services must be integrated with the other urban planning tools, seeking to associate both the policies and actions that conduct the municipal scenario considering the environmental and social heterogeneities in the elaboration, implementation and monitoring of public policies (Latu, 2009; Jana & Harata, 2016).

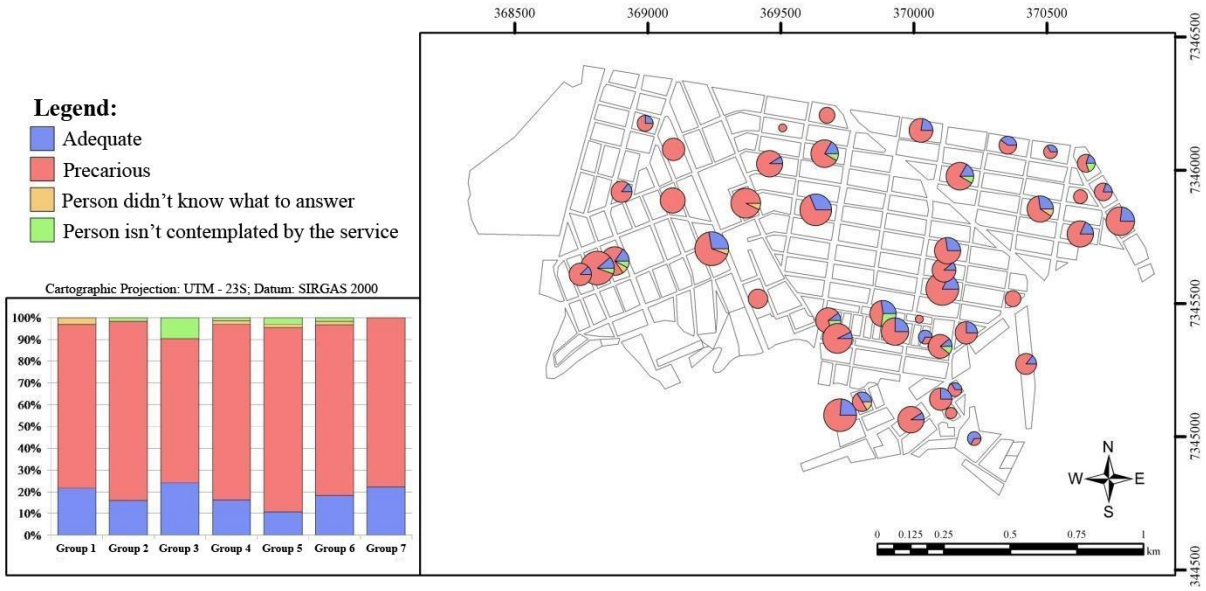
In relation to the urban drainage service, dissatisfaction was mentioned in all groups. Group 1 manifested the best evaluation for the provision of this service, with about 35% of people considering it as being adequate whereas Group 6 presented the worst evaluation in which 93% of the people interviewed considered the service inadequate. Both the management and planning of the municipal drainage network are essential since they are related to several other issues that directly affect the urban life quality amongst them floods and inundations, the inappropriate disposal, transport and accumulation of solid waste, as well as the rainwater quality (Tucci, 2002).

In this sense, the formulation and approval of the Macro Drainage Master Plan (Complementary Law 227/2018) can assist in the structuring and implementation of an adequate drainage system, in accordance with the established guidelines. The focus of this instrument is to carry out corrective and preventive actions for floods in the municipality, probably due to the absence of previous municipal legislation addressing this issue. However, the proposal to regulate the urban drainage system in the Basic Sanitation Plan (Complementary Law 228/2018) stands out, since it can be a mechanism for improving the provision of this service, meeting the demand identified in the present study.

Urban cleaning and solid waste management services were classified as precarious, being the most recurrent answer in all groups (Figure 4). Urban cleaning waste was the waste typology considered most harmful for most groups with the exception of Group 6 who listed household waste first and then urban cleaning waste (Figure 5).

Figure 4

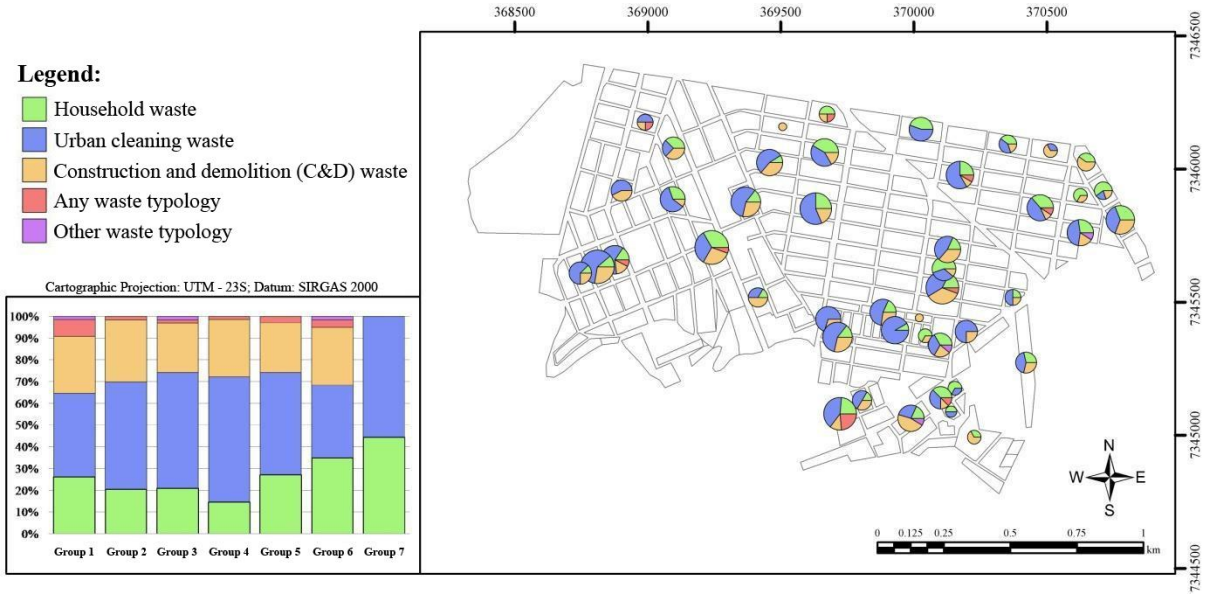
Graphic and spatial representation of the situation of the provision of urban cleaning and solid waste management services per study group in the neighborhood in Guarujá City in São Paulo



Note. Self-elaboration.

Figure 5

Graphic and spatial representation of the waste typology considered most harmful per study group in the neighborhood in Guarujá City in São Paulo



Note. Self-elaboration.

The negative evaluation of the urban cleaning service and the consideration of this typology as the most harmful indicate that the inadequate disposal of this waste typology, in

association with eventual deficiencies in the provision of this service, may be compromising for the proper functioning of the drainage system in the neighborhood, which is also highlighted by Complementary Law 228/2018. Tucci & Neves (2011) also found - when evaluating the composition of sweeping waste and waste transported by the drainage network in a watershed in Porto Alegre - that the composition of both was similar, indicating that the inadequate disposal of waste in public places negatively impacted this system. However, it should be noted that the impacts related to drainage do not always originate in adjacent regions, often reflecting the interaction of several factors in the downstream runoff basin (Souza, 2013), which may involve several areas of the neighborhood and the city, characterizing the occurrence of environmental and social externalities.

In addition to the consequences of inadequate disposal, irregular disposal hinders waste collection, recycling and composting programs, which lack social adhesion and active participation to maintain them. In this context, “door-to-door” selective collection, as an important instrument for waste management, was considered by the study groups to be more viable. The collection by PEVs/*Pontos de Entrega Voluntária* (Voluntary Delivery Points, in a free translation), a modality used in the city at the time of the study, was little remembered in the answers.

Solid waste disposal in inappropriate places promotes several aggravating factors in the urban context, such as the unpleasant odor, the proliferation of animals and insects that carry diseases, the social and economic devaluation of the disposal area, the possible soil and water contamination (both superficial and underground), the intensification of urban drainage problems, the transport of waste by rain and river waters, the erosion and silting in marginal areas of water bodies, visual pollution, among others (Tucci, 2002; Hoornweg & Bhada-Tata, 2012; Okpan et al., 2017). Thus, deficiencies in urban cleaning services and solid waste management can cause several public health issues, mainly due to the proliferation of diseases.

In this context, the adoption of practices that make solid waste management and public cleaning services provision more efficient can be an important strategy for reducing diseases related to basic sanitation, such as dengue fever. Apropos, this disease has affected the population of the municipality of Guarujá, which had the highest incidence of cases in the Baixada Santista region (Mendes & Costa, 2011).

When comparing the data on the coverage of basic sanitation services in the neighborhood (Table 4), it can be seen that the data collected in the present study are similar to those of the 2010 Census - 82.85% of the population served with water supply, 55.45% served with sewage network and 87.4% with solid waste collection (IBGE, 2010).

Table 4

Data on the percentage of households with provision of basic sanitation services in the Santa Rosa neighborhood calculated from official data from the 2010 Census (IBGE, 2010) and from the questionnaires applied in the present study. Data in parentheses refer to the percentage of households that rated the services as adequate

Study Group	Water supply		Sanitation		Solid waste management	
	Census	Questionnaire	Census	Questionnaire	Census	Questionnaire
1	97.26	100.00 (83.08)	46.20	98.4 (47.69)	99.12	98.46 (18.46)
2	99.54	100.00 (77.78)	88.92	95.24 (50.79)	99.56	92.06 (17.46)
3	99.90	100.00 (72.58)	90.52	100.00 (43.55)	100.00	98.39 (24.19)
4	99.88	100.00 (82.35)	85.50	76.47 (38.24)	100.00	95.59 (14.71)
5	99.44	98.48 (78.79)	88.06	68.18 (27.27)	100.00	100.00 (18.18)
6	100.00	100.00 (80.00)	91.07	86.67 (40.00)	100.00	98.33 (13.33)
7	100.00	100.00 (77.78)	100.00	100.00 (44.44)	100.00	100.00 (22.22)

Note. Self-elaboration.

In this sense, the water supply, urban cleaning and solid waste management services have a high coverage rate in the neighborhood, being above that observed for the national scenario (82.85% and 87.4%, respectively). On the other hand, the coverage of the sanitation service was quite variable between the study groups, as already discussed, but with most rates also above the national scenario in 2010 (55.45%). However, it is possible to verify that high rates of service provision are not directly related to positive evaluations by the population, in which the urban cleaning and waste management service stands out (Table 4).

This situation was discussed by Ribeiro Ayachi et al. (2012), focusing on water supply. According to the authors, the provision of low-quality services forces the population to seek alternatives to these services, which are often performed without adequate planning. Thus, inadequate storage and disposal of water, sewage and solid waste can negatively affect public and environmental health (Ribeiro Ayachi et al., 2012), impairing the quality of life in these areas.

From this perspective, the inclusion of popular perception to assess the quality of the provision of basic sanitation services proved to be efficient in demonstrating that the satisfaction of the population with provision of basic sanitation services is not directly related to the degree of coverage of these services. This statement is exemplified when we analyse information on coverage and satisfaction of urban cleaning and solid waste management services (Table 4). Therefore, it must be an integral part of the evaluation and planning stages of new actions. In this sense, the Municipal Basic Sanitation Plan plans customer satisfaction studies to be carried out every two years, aiming at designing plans to improve service's

provision (Guarujá, 2017; Complementary Law 228/2018).

Finally, regarding the population's access and perception on the basic sanitation and integrated solid waste management municipal plans, most of the interviewees stated they never had knowledge or access to the documents. However, a significant portion of the population considers this access to be important. These results indicate that the dissemination of plans and related documents may not be being carried out efficiently, as Rodrigues et al. (2012) suggest in their study, impairing social control and inhibiting the right to information and the effectiveness of the actions defined in the referred plans.

The formulation of programs and projects related to public policies must incorporate popular participation from the initial stages of planning (Siqueira, 2008) because, in this way, it is possible to identify and integrate the population's interests and demands, guiding public management towards the definition of priority actions (Freitas, 2015). However, for this process to be effective in bringing the decisions taken closer to the interests of the population, it is necessary to improve or develop communication mechanisms that raise awareness and motivate them to participate in this process (Rodrigues et al., 2012). Thus, it would be possible to plan, implement and evaluate actions that meet the priority interests of the social groups directly affected by those actions.

Identification of population demands related to basic sanitation

The analysis of the perception on the basic sanitation situation made it possible to identify the main population demands regarding the provision of services, in addition to various weaknesses and opportunities for intervention.

Regarding water supply, the demand for expanding the coverage of this service provision was identified in the areas where it was found, through the questionnaire, that there is a portion of the population without this service, comprising a block of Group 5. It is noteworthy that water supply is a strategic sector for improving the quality of life and public health, impacting infant mortality rates, water-related diseases, sanitary-environmental costs and directly affecting the population's feeling of well-being (Gandelman et al., 2012). In a municipal panorama since the 2010 Census, there has been a decline of 3.82% in the rate of the total population served, from 86.39% in 2010 to 82.57% in 2020, an indicator below the national reality (84.1%) (SNIS, 2020).

Considering sanitation, there was a need to expand this service coverage, due to the lack of access in some areas, and the need to improve its provision. Regarding the population's perception, Groups 1, 2, 3, 4, 5 and 6 should be defined as priorities for the implementation of actions to expand coverage. On the other hand, Groups 1, 2, 3, 4, 6 and 7 demand improvements in service provision. Taking into consideration the goals defined in the Plan

(Guarujá, 2017; Complementary Law 228/2018), the interventions in the groups that prioritized the expansion of the service coverage are fundamental for the city to fulfill what was planned and to guarantee the perspective of the universalization of sanitation. It is worth mentioning that since 2010, the municipality has increased the total population served by sanitation by 6.33%, with 70.05% of the population served in 2020, much higher than the national scenario of 55% (SNIS, 2020). In this context, it is observed that the existence of the Municipal Basic Sanitation Plan since 2010 and its revision in 2017 may have contributed to directing and performing investments in this service.

The adoption of measures that seek to meet these demands represents a necessity, in order to guarantee the human rights to safe and clean drinking water and sanitation. Also, in the area of public health, the actions make it possible to reduce costs with healing measures, since sanitation actions contribute to controlling and reducing the spread of various diseases associated with unhealthy environmental conditions (Crispim et al., 2013).

Regarding solid waste, on the one hand, there is a need to improve the management of household and urban cleaning waste, considering the growing volume generated, the increase in its dangerousness and the expansion of environmental degradation with repercussions on public health. On the other hand, there is also a priority to expand the coverage of urban cleaning services in Groups 2, 3, 4, 5 and 6, which have a portion of the population without provision. As a result, the PNRS/*Política Nacional de Resíduos Sólidos* (National Solid Waste Policy, in a free translation) points to the adoption of integrated solid waste management and determines a set of actions considering the political, economic, environmental, cultural and social dimensions. In addition to integrated management, the PNRS determines priorities for waste management starting with generation prevention, minimization, reuse, recycling, solid waste treatment and environmentally adequate final disposal (Law 12,305/2010).

In this sense, the Municipal Plans (Ordinary Law 4,367/2016; Complementary Law 228/2018) establish goals and actions that aim at the proper solid waste management, defined according to the specific situations of the municipality. In this way, the local government hopes to promote the universalization of household solid waste collection by 2020, which can be considered viable, given the degree of coverage existing in the study groups (Table 4). SNIS Data on the population provided with household solid waste collection may not directly contribute to this analysis, given that since 2011 the city claims to serve 100% of the population, above the national provision of 90.5% (SNIS, 2020). This data, associated with the questionnaire's results, points to the need for monitoring and improving data collection and provision of this service.

There is also a plan to expand the population served by the PEVs, also called *ecopontos* (ecopoints, in a free translation), for selective collection until 2021 (Guarujá, 2016;

Ordinary Law 4,367/2016). However, the results of the present study indicate that there is no popular interest in this alternative for recyclable waste management. Even so, the Plan establishes communication measures to publicize the system to the population and raise awareness, in case the system proves to be inefficient (Ordinary Law 4,367/2016).

As one of the instruments to support solid waste management, a “door-to-door” selective collection system was demanded by the population of the neighborhood. This type of collection is considered possible to be implemented in the Municipal Plan for Integrated Solid Waste Management (Guarujá, 2016), which emphasizes that priority should be given to the participation of cooperatives (or any other forms of association of waste pickers) to implement this system. More recently, the PRGIRS/BS/*Plano regional de gestão integrada de resíduos sólidos da Baixada Santista* (Regional Plan for Integrated Solid Waste Management of Baixada Santista’s Region, in a free translation) (2018) identifies selective collection as a regional challenge and points to the need to universalize the selective collection in the city, as well as improve the environmental education, identifying municipal projects in this matter.

On the other hand, expanding the coverage of urban cleaning services is a priority in Groups 2, 3, 4, 5 and 6, which have a portion of the population without this service. In the field of drainage, the expansion of coverage in the provision of this service was identified as a priority in Group 4, which has residents who claim not to be provided by the service. In addition, the improvement of urban drainage services was established as a priority for the groups where most of the population considered the provision to be precarious.

As previously discussed, the Macro Drainage Master Plan (Complementary Law 227/2018) defines guidelines for urban drainage systems management in the municipality. From this perspective, the use of GIS to monitor the system is constantly highlighted throughout the actions (Complementary Law 227/2018). Having a Master Plan for this sanitation component places the city of Guarujá among 17.4% of Brazilian municipalities that have this document, occupying a satisfactory position in the national scenario (SNIS, 2020). In this way, the spatialization of the population's perceptions and demands can be integrated with the information collected on the evaluation of this service, allowing the improvement of urban drainage according to the interests of the populations covered by the system.

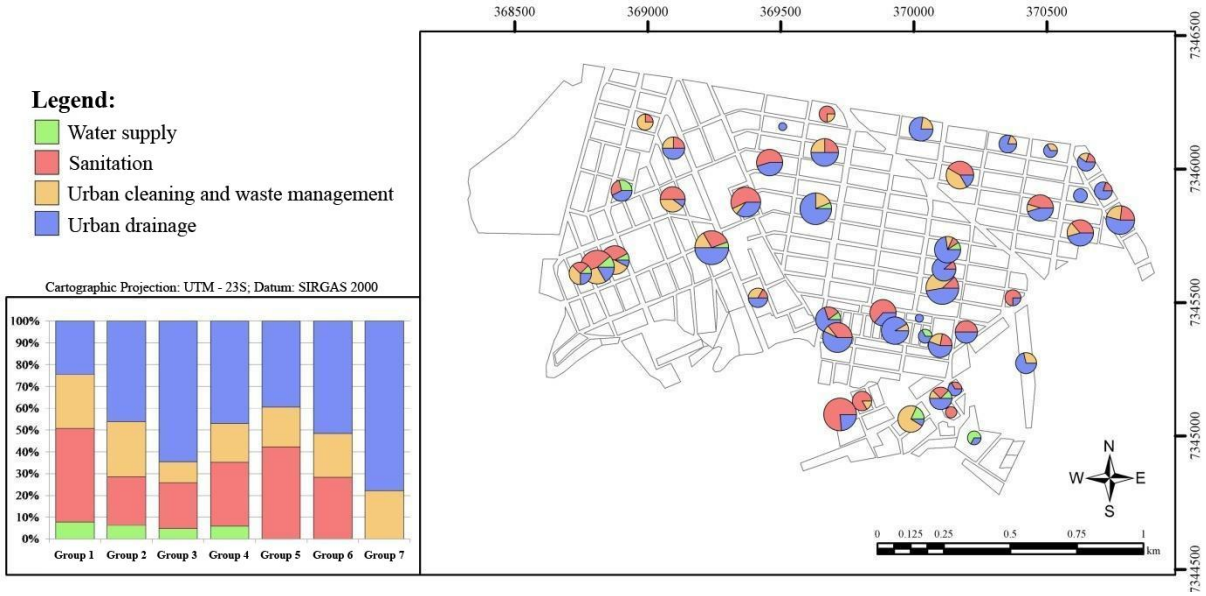
Besides, the actions foreseen in the Plan (Complementary Law 227/2018) aim to integrate, among other aspects, urban cleaning services with the maintenance of channels and stormwater drainage galleries. Thus, the expansion and operation of both services must be planned in an integrated manner, considering that the amount of solid waste that is carried into the drainage network is strongly related to the frequency of sweeping and household waste collection (Complementary Law 228/2018; Neves & Tucci, 2011), as well as the way in which waste is packed by the population. In this sense, the Municipal Plan for Integrated Solid Waste Management points out that proper waste management has as one of its consequences, the

improvement of the drainage network, thus not deepening on the integration of measures or indicators, for example. The PRGIRS/BS does not provide information on the relationship between waste management and drainage (Guarujá, 2016; Ordinary Law 4,367/2016; PRGIRS/BS, 2018).

Finally, in addition to assessing the situation of the provision of basic sanitation services, it was also identified, according to the population's perception, the service with priority demand for improvements. Thus, the services with the greatest demands were urban drainage and sanitation (Figure 6). Urban cleaning and waste management services were characterized as a medium priority (second or third priority level). Water supply was defined as the lowest priority in all groups analysed, confirming the perception that the quality of the current service provision is more satisfactory than other services.

Figure 6

Graphic and spatial representation of priorities for improvement in basic sanitation management per study group in the neighborhood in Guarujá City in São Paulo



Note. Self-elaboration.

Considering the prioritization of demands for improvements and the situation of basic sanitation services individually, most groups defined the service with the worst evaluation as the priority, with the exception of Group 5. In this group, the drainage service was considered by 86% of respondents as precarious, while the greatest demand for improvement was considered to be sanitation, indicating that the relationship between the provision of services and the demands of the population is not always direct, reflecting the complexity in the

management of the supply of basic sanitation services.

This result reveals the importance of identifying the demands of the population as a tool for formulating policies that consider local characteristics, making them more applicable and effective, in addition to monitoring the quality of basic sanitation services provision. The spatial approach on basic sanitation services makes it possible to identify weaknesses and potential for interventions in the neighborhood, as well as their monitoring.

In this sense, basic sanitation constitutes one of the cornerstones of municipal sustainability, as it can be seen in the United Nations SDGs/Sustainable Development Goals, especially in goals 6 – Clean water and sanitation and 11 – Sustainable cities and communities (UN, 2015). Studies that correlate sustainable municipal strategies and the role of actors or stakeholders point issues related to basic sanitation as emerging in the process, especially solid waste management, urban resilience, sustainable infrastructure and disaster risk reduction (Beck & Storopoli, 2021).

The results highlight the interactions and roles of two of the four main actors (Crumpton et al., 2021) involved in basic sanitation, especially in the urban context: civil society – the target of this study – and public authorities. Civil society has an important role in all stages of basic sanitation management, and its relevance in the monitoring and evaluation of services was particularly addressed here, but it is also necessary to highlight its importance in the planning stages, for example.

Public authorities, in turn, have the role of leading the public policy process. In the case of the local sphere, the city of Guarujá – and the institutions that comprise it – must adapt national and state basic sanitation policies to their local context, taking into account the municipality's socioeconomic and environmental characteristics, among others. Thus, carrying out adequate basic sanitation planning at the local level, articulating the interested parties, the stakeholders, around this planning, meeting the different demands in order to ensure the quality and sustainability of services. Public authorities are also responsible for decision-making and prioritizing basic sanitation on the local agenda.

Additionally, it is important to point out two groups of actors that play a relevant role in basic sanitation – universities and the business and industrial sector (Crumpton et al., 2021). Universities hold technical and academic knowledge that is often difficult for other actors to access. In this sense, it is essential that they are part of the planning process, contributing to identifying challenges and possible alternatives to face them. There are several examples in the Brazilian society, i.e., the elaboration of the PNSR/*Programa Nacional de Saneamento Rural* (National Rural Sanitation Program, in a free translation), prepared by the Federal University of Minas Gerais in partnership with civil society and the Funasa/*Fundação Nacional de Saúde* (National Health Foundation, in a free translation) being awarded at the 22nd Enap/National School of Public Administration Innovation Contest (Funasa, 2022).

Finally, the business and industrial sector plays a relevant role in contributing to the stages of provision of basic sanitation services, being fundamental partners in achieving the goals of service provision and quality of services. In this sense, the articulation of this actor with the others is crucial so that basic sanitation services are provided adequately in terms of quantity and quality.

Final considerations

This article brings an original approach to the evaluation of basic sanitation services in a city by integrating spatial aspects with the perception of the population, using the 2010 Census as a base to define the study area and target population of the research. The methodological model developed is viable to be reproduced in other neighborhoods of the same municipality or even in other municipalities, allowing temporally and spatially referenced information record.

According to the perception of the inhabitants, the situation of the provision of basic sanitation services in the Santa Rosa neighborhood, in Guarujá, São Paulo, presents limitations and inadequacies in certain services. Considering the neighborhood in its entirety, urban drainage and sanitation showed less satisfactory results than the other services. Therefore, these services should be a priority for promoting services universalization.

In general, results indicated a high heterogeneity in the perception of the interviewees regarding the provision of basic sanitation services in the neighborhood, both in terms of provision and in relation to the quality of services.

From the perspective of the actors involved in municipal basic sanitation, this study highlighted the relevance of the civil society participation in this public policy, particularly in services monitoring and evaluation. In addition, the role of public authorities as the articulator of policy and the participation of universities and the private sector are essential for sustainable municipal strategies to be implemented, as in the policies and plans presented in the article.

In this sense, it is observed that, despite the recent inclusion of social participation in the planning and formulation of public policies in the country, this process remains a challenge. From the perspective of regulating policies related to basic sanitation, there is a need for the public authorities, especially in the city, to act more effectively, operating as an articulator with regard to the involvement of the population in planning, implementation, monitoring and improvement of such policies, promoting greater social participation and integration of those interested in basic sanitation.

Although the research has evident limitations, notably regarding the small scope of the study area, in addition to the questionnaire representing a temporal picture that dynamically changes over time, the results can contribute to the review and updating of municipal

regulations, such as basic sanitation, land use, and occupation plans. Additionally, priority urban areas for investment in each basic sanitation component are also identified, which contributes for orientating investments, programs and actions. Thus, the strategy of this research is considered as a potential and important tool to support discussions between public management and service providers for decision-making at the municipal (micro) level.

Henceforth, research like this, which seeks to understand the population's perception, can contribute to the improvement of public policies already operative in the municipalities and encourage their improvement, making it possible for them to reflect and contemplate the real demands of the population, thus promoting the improvement of local public health, environmental health and, ultimately, the quality of life of the inhabitants of the Santa Rosa neighborhood.

This research opens the door to an agenda of studies that seek to assess the population's perception of public services and, particularly, incorporating Census data, whether about service provision or spatial information. Possibilities for future research are suggested: (i) analysis of the integration of municipal public policies (tiering); (ii) the role of different social actors in municipal public policies; (iii) the spatialization, by Census sector, of the goals related to Plansab and the Sustainable Development Goals; (iv) replication of this survey after the next publication of the Census; and (v) analysis of the incorporation of studies and planning into local decision-making processes.

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Appendix I: Questionnaire

Question 1: Which type of waste is most harmful to the neighborhood?
[ ] Household waste [ ] Urban cleaning waste [ ] Construction and demolition waste [ ] Other (Which one?) [ ] None

Question 2: Which type of selective collection is most viable for the neighborhood?
[ ] by “Voluntary Delivery Points” (PEVs) [ ] “door-to-door” selective collection [ ] Other (Which one?) [ ] None

Question 3: You consider the water supply service as:
[ ] Adequate [ ] Precarious [ ] I don’t know [ ] I’m not provided with this service

Question 4: You consider the sanitation service as:
[ ] Adequate [ ] Precarious [ ] I don’t know [ ] I’m not provided with this service

Question 5: You consider the urban cleaning and waste management service as:
[ ] Adequate [ ] Precarious [ ] I don’t know [ ] I’m not provided with this service

Question 6: You consider the urban drainage service as:
[ ] Adequate [ ] Precarious [ ] I don’t know [ ] I’m not provided with this service

Question 7: Which basic sanitation service should be prioritized for improvement in the neighborhood?
[ ] Water supply [ ] Sanitation [ ] Urban cleaning [ ] Urban drainage

Question 8: Have you had access to any of these plans?
[ ] Yes [ ] No [ ] I don’t know

Question 9: Do you consider it important for people to have access to this type of document?
[ ] Yes [ ] No [ ] I don’t know