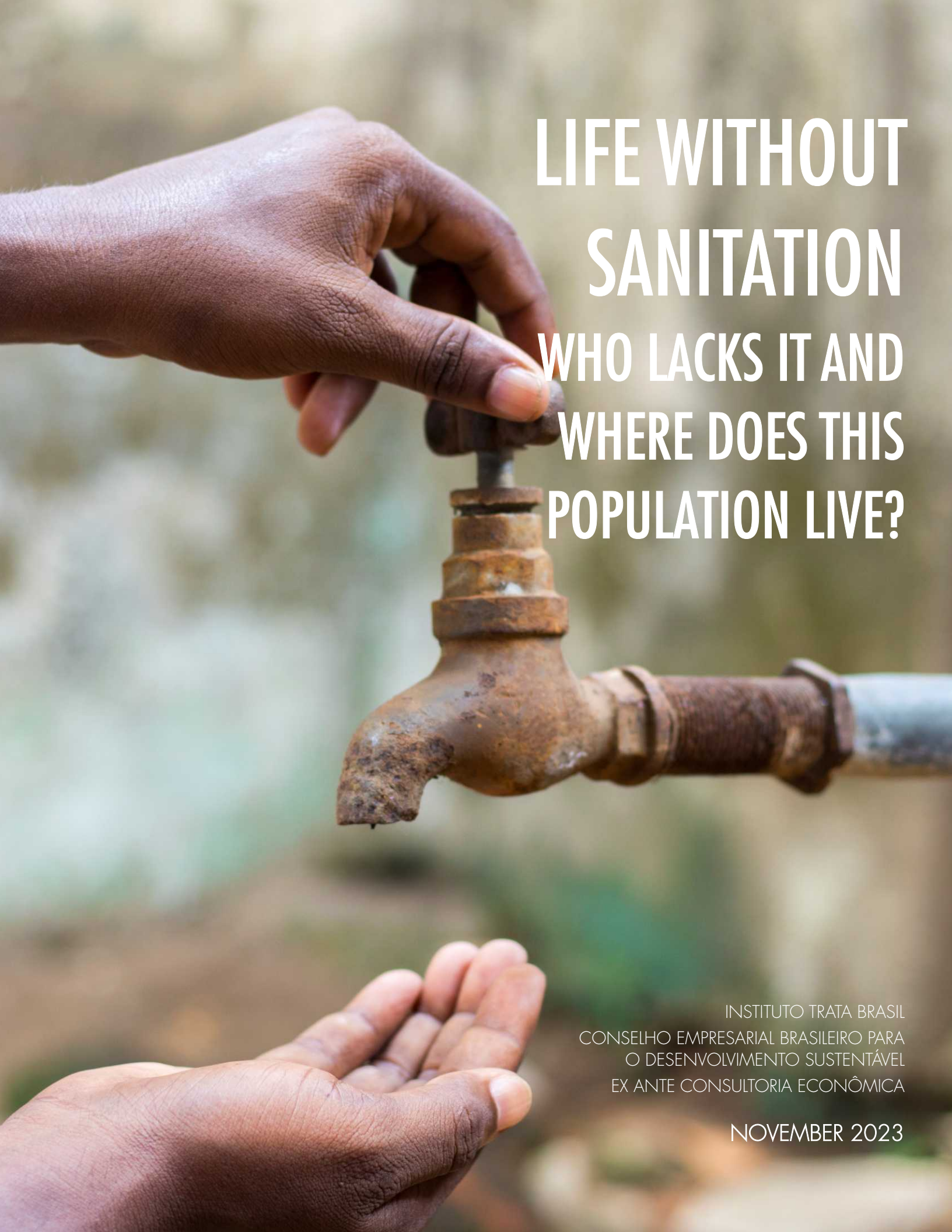
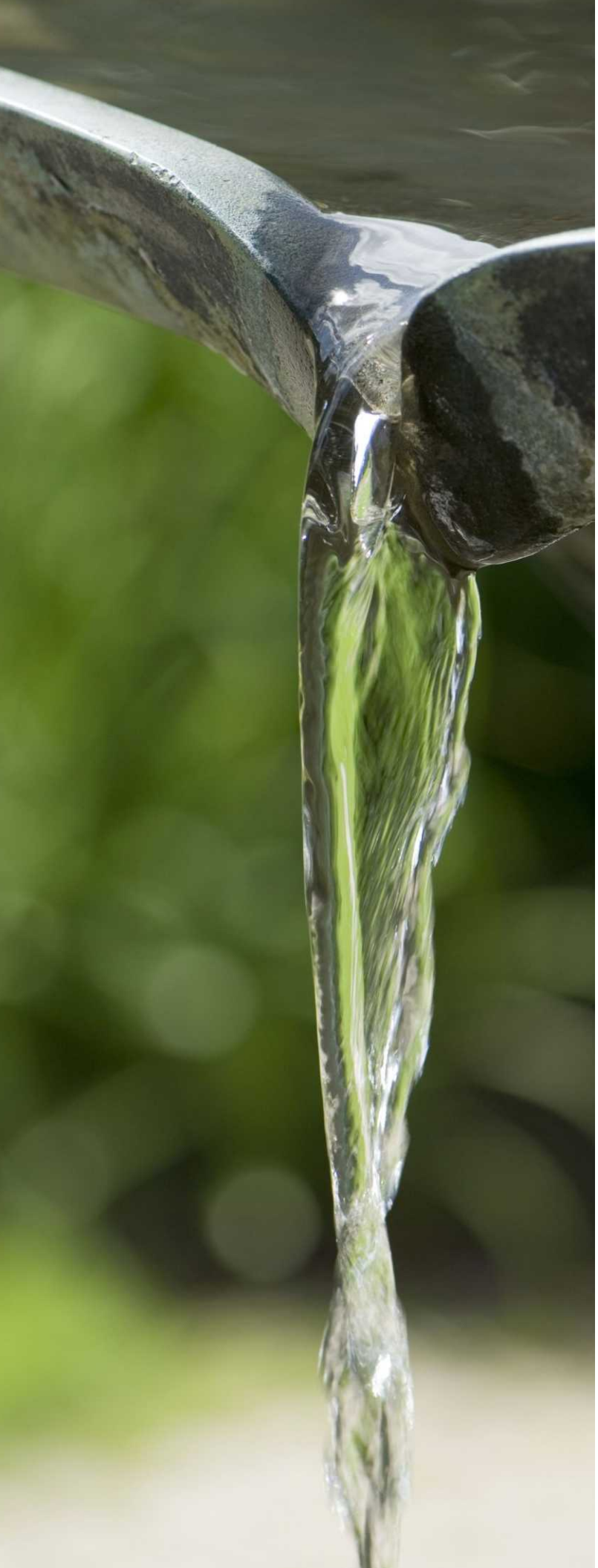


LIFE WITHOUT SANITATION

WHO LACKS IT AND WHERE DOES THIS POPULATION LIVE?

INSTITUTO TRATA BRASIL
CONSELHO EMPRESARIAL BRASILEIRO PARA O DESENVOLVIMENTO SUSTENTÁVEL
EX ANTE CONSULTORIA ECONÔMICA

NOVEMBER 2023



Trata Brasil
Saneamento é saúde

cebds

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Contents

2023 NOVEMBER

1

INTRODUCTION

This study traces the socioeconomic profile and regional distribution of the population deprived of sanitation services in Brazil. A set of five types of sanitation deprivation are analyzed:

(i) access to the general treated water distribution network;
(ii) adequate regularity in the supply of treated water;
(iii) the availability of a drinking water storage tank;
(iv) the existence of a bathroom for the exclusive use of the household; and
(v) access to the general sewage collection network.

The analysis covers the 2013-2022 period of IBGE's Annual National Continuous Sample Household Survey (PNADCA). It also reviews information on the incidence of waterborne diseases and respiratory diseases in the population group that is in some form of sanitation deprivation. This second analysis uses data from the 2019 National Health Survey, also by the IBGE, which makes it possible to correlate the incidence of these diseases with the sanitation conditions to which people are subject.

Analysis roadmap

In addition to this introduction, the study is divided into seven other sections. Section 2 defines sanitation deprivation and outlines the working assumptions of the study. It also presents aggregate statistics for 2022 on the occurrence of sanitation deprivations. Section 3 details the issue of deprivation of access to the general treated water distribution network, focusing on regional distribution and changes in this situation between 2013 and 2022.

Next, we will analyze the characteristics of homes that lack access to a water network and the profile of the population living in these homes. Sections 4 to 7 follow the same approach for the other four situations of deprivation, i.e., insufficient supply frequency; availability of a water storage; deprivation of a toilet; and deprivation of sewage collection.

Section 8 analyzes the implications of lack of sanitation on public health, specifically focusing on waterborne diseases, respiratory diseases, and oral health. The document concludes with the Bibliographical references, Statistical Annex, and Methodological Annex.

Main findings

The study revealed that close to one in every two Brazilians experience some form of sanitation deprivation in their homes. This may be due to a lack of connection to the general treated water supply system, irregular water supply, inadequate water storage facilities, lack of connection to the sewage collection system, or even the absence of a toilet. A total of 102.7 million Brazilians experienced this situation of deprivation in 2022.

The Northeast Region had the highest number of people with sanitation deprivation, with 40.3 million individuals, accounting for 39.5% of the total population experiencing sanitation deprivation in Brazil. This means that seven out of ten Northeasterners lived in housing with some kind of problem.

The Southeast was the region with the second highest number of people in a state of deprivation, with 21.6 million people. However, the Southeast had the lowest proportion of people at just two out of every ten, compared to other regions. Next came the North Region with 15.9 million people in a state of deprivation. In comparison to the Northeast, the proportion was even higher, with eight out of every ten people in this situation.

The South Region failed to perform better. In 2022 there were nearly 15.9 million people facing deprivation. The proportion of people living in deprivation was one in every two inhabitants, which is the same as the national average and the Center-West Region.

Considering each individual deprivation situation, the study found that:

- The deprivation of access to the general sewage collection system impacted 69.7 million people in 2022. This represented 32.5% of the country's population. Nearly 60% of these Brazilians lived in the Northeast and North regions. In the Northeast, two out of every ten people were in a situation of deprivation of this kind and in the North, four out of every ten people. Between 2013 and 2022, there was some progress with 8.6 million people leaving this state of deprivation. However, the rate at which this deprivation has been reduced has been very slow, at just 1.3% per year.

- Irregular supply of treated water impacted 51.2 million Brazilians in 2022. This represented 23.9% of the country's population. Nearly 46% of these Brazilians lived in the Northeast region. There, four out of every ten people were in a situation of deprivation of this kind. The Southeast of Brazil had 12.5 million people without a regular supply of treated water, which represented 24.4% of the national total. In the North Region, the incidence of people with this type of deprivation was 44.4%, the highest of all the regions. Distribution between areas is similar to that of the problem of access to the network: half of the people with irregular supply lived in rural areas, where the incidence of this deprivation was 23.3%. The other half lived in urban areas, and the problem was also more serious in relative terms, as the incidence was 24.5%.

- The deprivation of water-storage facilities, in turn, impacted close to 32 million people in 2022. This represented 14.9% of the country's population. Half of these Brazilians lived in the Northeast and North regions. In the Northeast, two out of every ten people faced a situation of deprivation of this kind and in the North, three out of every ten people. In this case, the number and incidence of people living in homes without a water storage tank in the South Region is striking: in 2022 there were 7.9 million people, or 25.6% of the region's total population.

- The deprivation of access to the general treated water distribution system impacted 27.3 million Brazilians in 2022. This represented 12.7 percent of the country's population. Nearly 60% of these Brazilians

lived in the Northeast and North regions. In the Northeast, two out of every ten people were in a situation of deprivation of this kind and in the North, four out of every ten people. Nearly half of the people deprived of treated water supply lived in rural areas, where the incidence of this deprivation was 12.1%. The other half lived in urban areas, and the problem was also more serious in relative terms, as the incidence was 13.4%.

- The deprivation of access to private toilet facilities impacted 4.4 million Brazilians in 2022. This represented 2.1 percent of the country's population. More than 95 percent of these Brazilians lived in the Northeast and North regions. In the North, eight out of every ten people were in a situation of deprivation of this kind and in the Northeast, five out of every ten people. This problem affects mostly the poor: of the total number of people deprived of a toilet, 76.2% live in homes with a monthly income below R$2,400.

The study also identified that deprivation of sanitation has implications on the health of the population. The main relationships analyzed indicate that:

- People living in homes with poor sanitation are significantly more likely to miss work or school as a result of waterborne diseases. Lack of access to the water distribution network, lack of a toilet and lack of access to the sewage collection system increase exposure to acute gastrointestinal infections and diseases caused by insect vectors.

- The population living in homes without access to water or toilets is significantly more likely to be absent from work or school due to respiratory diseases, indicating that people without these services are more exposed to flu and pneumonia. Lack of access to a sewage system does not affect the incidence of these diseases.

- People living in homes with poor sanitation are significantly more likely to miss work or school as a result of oral diseases. The coefficients associated with lack of access to the water distribution network, deprivation of a toilet and deprivation of access to sewage collection are all positive and statistically significant, indicating that people deprived of these services are more exposed to oral problems in general. The statistical model indicates that a family deprived of access to the treated water network is almost twice as likely to contract oral diseases as a family with access to the general treated water distribution system.

In any of the three types of disease, it was found that the advance of treated water distribution and sewage collection networks has contributed positively to reducing the incidence rates of these diseases from 2010 onwards.

Finally, the study investigated the characteristics of these homes and the profile of people facing deprivation of sanitation. What are the living conditions like in homes with poor sanitation and who are the people residing in them?

A home lacking proper sanitation is typically located in the rural zone of a smaller town or in the outskirts of the larger metropoles. It is witnessed more frequently in some states of the Brazilian Northeast and North regions, such as Pará, Maranhão, and Piauí. This situation is also seen frequently in informal settlements based in metropolitan regions. Generally, these are homes with a precarious structure, because of improper material used in their walls, roofs, and floors. Walls are of discarded wood and the roofs are either wood or straw. The floors are either cement or dirt. These houses have only three to four areas: a living room, kitchen, and one or two bedrooms. The kitchen lacks treated water. Garbage is either burned in the yard or tossed in vacant lots.

This house is home to a family of three or four. Generally, a mother with two children or a couple with two children. At times, the family is larger, with five or six members. It is not uncommon to have a grandchild living there as well. Indeed, there are many children and the parents are young. These families are mixed race, which is common in Brazil. These are simple people, lacking instruction, but hard workers. They are poor and most often the money they have is not enough for them to have a decent life. The lack of water in a house lacking toilets and sewage collection ultimately impacts the health of these people. They suffer more frequently of diarrhea and vomit and because of this miss work or school. They have more cases of flu and pneumonia than other Brazilians. This makes their lives even harder and their future uncertain.

2

DEPRIVATION OF SANITATION SERVICES

2.1. Definitions and assumptions

The study of sanitation deprivation started by classifying the sanitation facilities available in Brazilian families' homes and which are regularly surveyed. The facilities are: (i) access to the general treated water distribution network, for those who have such access; (ii) adequate regularity in the supply of treated water; (iii) the availability of a drinking water storage tank; (iv) the existence of a bathroom for the exclusive use of the household; and (v) access to the general sewage collection network. It should be noted that these issues deal with different dimensions of the problem of lack of sanitation. In some of them, such as the availability of a toilet, they refer to conditions strictly linked to the quality of housing. In others, such as access to the sewerage network, they are also linked to the existence of the network, which is a public utility service beyond the walls of the home.

The study's data comes from the Annual National Continuous Sample Household Survey (PNADCA), which has been carried out continuously by the IBGE since 2012. This study takes into account information available in the survey's microdata banks for the years 2013, 2016, 2019, and 2022. These databases gather information on the residents of all the households visited by the IBGE team each year. The survey's sample weights are also available in the databases, making it possible to estimate the statistics very accurately for various levels of regional aggregation, from the municipal level for the capitals to national aggregates.

The PNADCA survey covers various demographic and socio-economic aspects of the population and uses a sophisticated international standard methodology. It provides information to trace the construction profile of housing and the socioeconomic profile of the population in a state of sanitation deprivation, which is the central objective of our study. In addition, this database makes it possible to correlate this information and indicate which socioeconomic characteristics interfere with the deprivation of sanitation services.

The names of the PNADCA variables used to construct the sanitation deprivation measures and the concepts behind these measures are shown in Table 2.1, which also contains some observations on the five dimensions of deprivation.

For each of these five situations of sanitation deprivation, the study provides an analysis of both the number of dwellings and the population involved. First, an analysis is conducted on the regional distribution of housing and population in a state of deprivation. The information is disaggregated between large regions, states, and rural and urban

Figure 2.1.
Definitions of the dimensions of sanitation deprivation

Dimensions	Variable	Definition	Note
1. Deprivation of access to the general treated water distribution system	V0212 for 2013 and S01008 for the other years	The homes or people with access to the service are those connected to the networks, regardless of whether water from the general network is the main form of supply. The others are deprived of the access to treated water.	There is a methodological difference between 2013 and the other years: in 2013 only the access of households with piped water is considered.
2. Insufficient delivery frequency	S01008	Households or people with insufficient water supply are those that are connected to networks, but the water they receive from the general network is not the main form of supply, or those that do not receive water on a daily basis.	There is no information for 2013.
3. Availability of water storage	S01009	Dwellings or people without reservoirs are those without water storage tanks, cisterns or other types of drinking water tanks.	There is no information for 2013.
4. Lack of toilet	V0215 to V0217 for 2013 and S01011 for the other years	Toilet-deprived dwellings or people are those that do not have a toilet for exclusive use in the dwelling.	There is a small methodological difference in 2013, but this does not compromise the time comparison.
5. Lack of sewage collection	V0218 for 2013 and S01012 for the other years	Dwellings or people in a state of deprivation of sewage collection are those that are not connected to the general or rainwater sewage collection system.	The connection of a septic tank to the network is not considered a situation of deprivation.

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

areas. Next, the trends in deprivation indicators over time (from 2013 to 2022) are investigated. Third, the housing profile for each situation of deprivation is analyzed. In this investigation, various characteristics of the dwellings were taken into account: the type of dwelling (house, apartment, or room); the finishing materials of the walls, roof and floor; the disposal of waste; and the ownership of the property. The analysis also includes the following resident characteristics: gender, age group, self-reported race, education level, monthly household income, and poverty status.

Finally, we should point out that all the analyses show (i) the distribution of total deprivation cases between regions, housing characteristics and population profile and (ii) the relative frequencies of cases in each group. In the graphs, tables and maps, information is presented on how much the state of Ceará represents in the total number of homes without access to treated water in the country (type i information) and on the proportion of homes in Ceará that are in a state of deprivation, in the latter case, considering the total number of homes in the state (type ii information), for example.

2.1. 2022 aggregate statistics

Before presenting the detailed analysis results, we will briefly outline the total number of sanitation deprivation cases found in Brazil in 2022. Table 2.1 shows these statistics, highlighting the number and

relative frequency of dwellings and inhabitants subject to each of the situations of deprivation.

Of the total of 74.145 million Brazilian households, 12.0% (or 8.916 million) had no access to the general treated water supply network in 2022. These dwellings were home to 27.270 million people, which accounted for 12.7% of the country's population.

In addition to the homes without access to treated water systems, another 7.980 million homes were identified as not receiving water on a daily basis, despite being connected to the general water supply network. This contrasts with the recommendation of the World Health Organization and the National Sanitation Plan. As a result, a total of 16.896 million households, or 22.8% of the country's homes, were supplied water at insufficient frequency. These people totaled 51.197 million, or 23.9% of the country's population.

This irregular water supply is particularly serious in dwellings that lack treated water storage equipment. If no one is awake when the water is supplied in these homes, it cannot be used for cooking, cleaning, or personal hygiene. This was the case for 10.856 million dwellings without a water storage tank, where 31.954 million Brazilians lived in 2022.

The most basic of sanitation services, and the one that has the greatest impact on quality of life, is the availability of a toilet for exclusive use in the home. This problem affected 1.332 million homes in Brazil in 2022. These dwellings were home to 4.412 million people with very limited quality of life.

In 2022, 22.832 million homes had no sewage collection service. This indicates that three out of every ten households did not have an effective system for removing waste from their homes. People in this situation totaled 69.706 million, or 32.5% of the country's population.

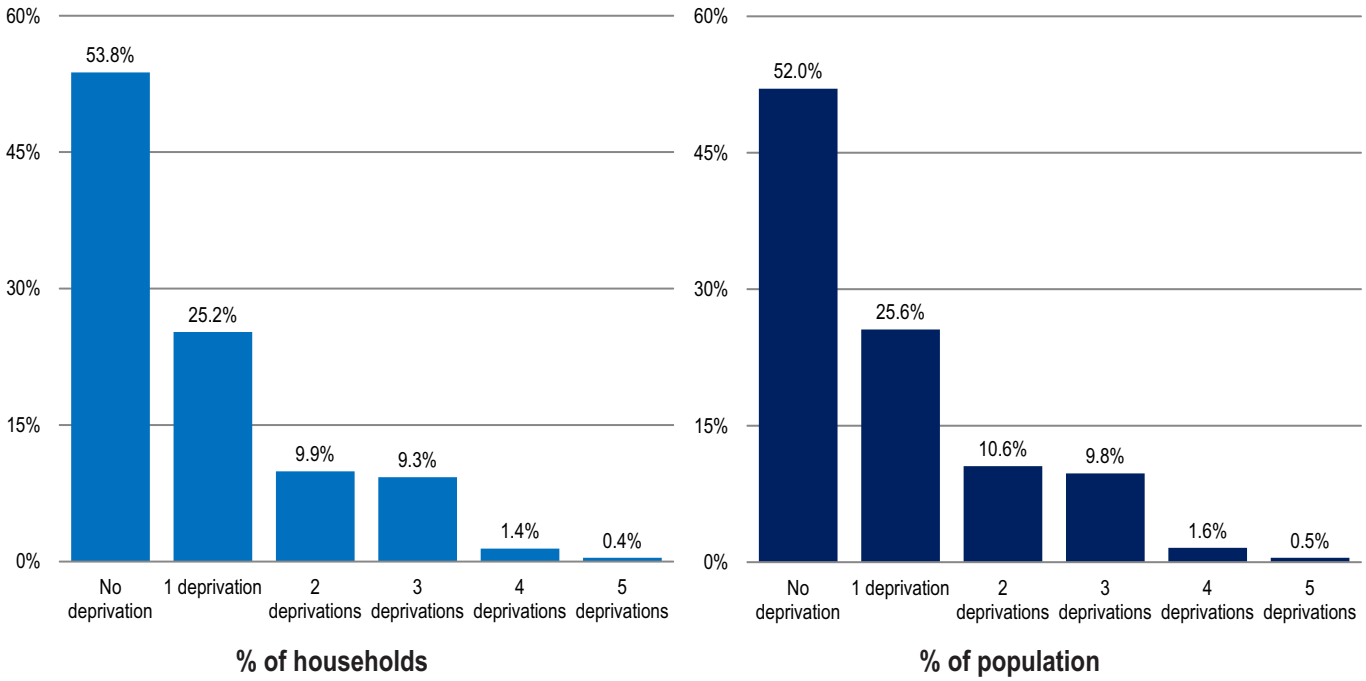
Finally, we should note that many people suffer from more than one type of deprivation, which further compromises their quality of life. Graph 2.1 shows that 25.2% of the country's dwellings had at least one deprivation from this list of five situations, but another 21.0% had more than one deprivation, with a higher frequency of dwellings with two or three types of deprivation in 2022. But most serious of all, 46.2% of Brazilian households had one of these five problems. This means that 48% of the Brazilian population live without proper sanitation, which means that one in every two Brazilians lacks access to basic sanitation.

Table 2.1.
Number of dwellings and inhabitants in deprivation of sanitation services, Brazil, 2022

Dimensions	Dwellings		Population	
	Number	(%) of total	Number	(%) of total
1. Deprivation of access to the general water distribution system	8,915,929	12.0%	27,270,486	12.7%
2. Insufficient delivery frequency	16,896,340	22.8%	51,197,240	23.9%
3. Availability of water storage	10,856,039	14.6%	31,954,297	14.9%
4. Lack of toilet	1,331,733	0.7%	4,411,503	2.1%
5. Lack of sewage collection	22,.831,778	30.8%	69,705,560	32.5%

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 2.1.
Percentage of households and population deprived of sanitation services, by number of deprivations, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

3

DEPRIVATION OF ACCESS TO THE GENERAL TREATED WATER DISTRIBUTION SYSTEM

3.1. Regional distribution

According to PNADC statistics, in 2022 a total of 8.916 million Brazilian dwellings were not connected to the general network for supplying treated water. This figure represents 12.0% of all homes in Brazil.

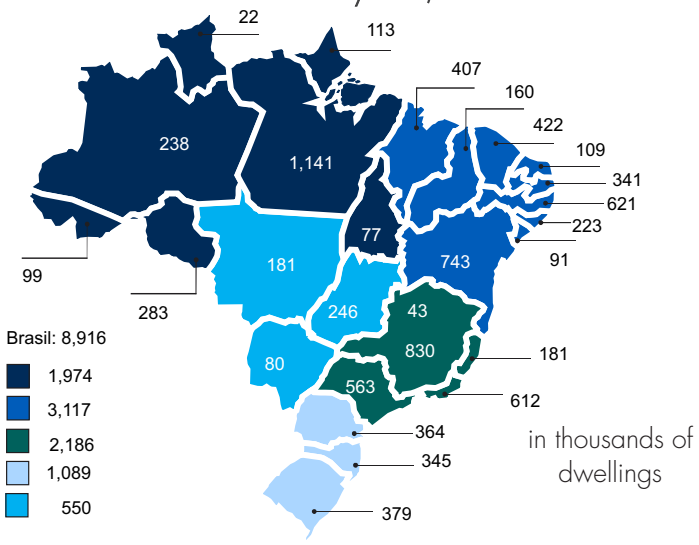
Most of the homes lacking access to the water network (35.0%) were in the northeastern states of Brazil, totaling 3.117 million homes in 2022. Among states in the Northeast Region, the highest concentration of dwellings with this deprivation was in Bahia, Pernambuco, and Maranhão. In that region, close to 17 out of every 100 dwellings were not connected to the general network for supplying treated water. In three states, however, this proportion was very close to or passed the 20 per 100 mark, as was the case in Paraíba, Alagoas, and Pernambuco.

In the North Region, the problem was also very severe, with 1.974 million homes lacking access to the general water network, or 22.1% of all homes in Brazil in this situation. In this case, however, the share that these dwellings represent of the total number of dwellings was even higher than in the Northeast Region: 35 out of every 100 households did not have access to the general water network in 2022. Nearly all states in the North Region faced problems. In the states of Pará and Amazonas, 1.141 million and 232,000 dwellings, respectively, lacked access to the general treated water distribution system. In relative terms, however, the highest proportions of dwellings in this condition of deprivation occurred in Rondônia (45.3% of the total population), Pará (43.4%) and Roraima (46.1%).

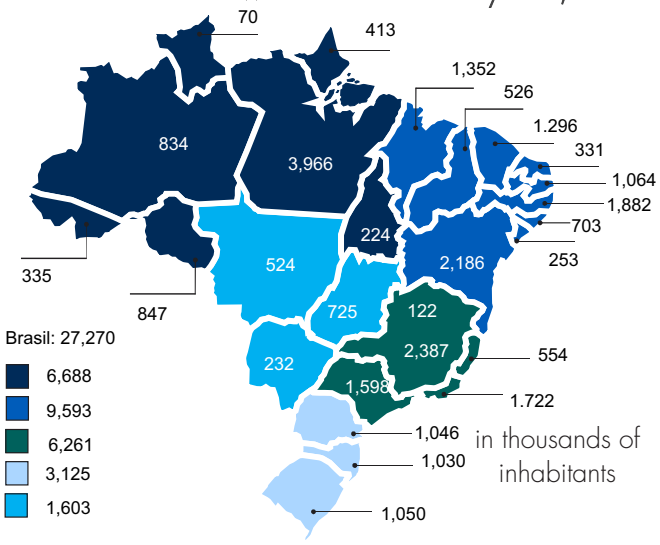
The Southeast Region concentrated 2.186 million homes lacking access to the general treated water supply network in 2022, which represented 24.5% of the national total. Incidence rates were highest in the state of Espírito Santo, with 12.5% of the state's homes, and in Minas Gerais, with 10.9% of local homes.

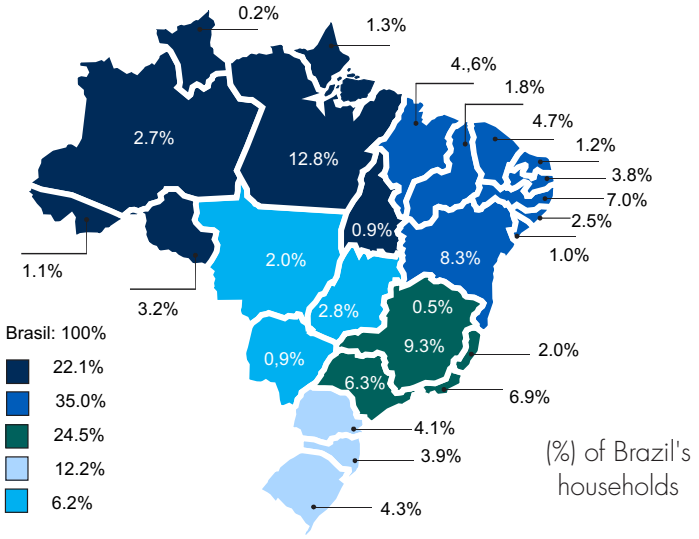
The number of Brazilians living in dwellings lacking access to a general water supply network in 2022 was 27.270 million people. This represented 12.7% of the country's population. In terms of population, most of the problem (35.2%) was also located in Brazil's northeastern states, totaling 9.593 million people in 2022. The highest concentration of people deprived of access to the public water network was in the states of Pernambuco, Maranhão, and Ceará. In Paraíba, 26 out of every 100 people lacked access to treated water.

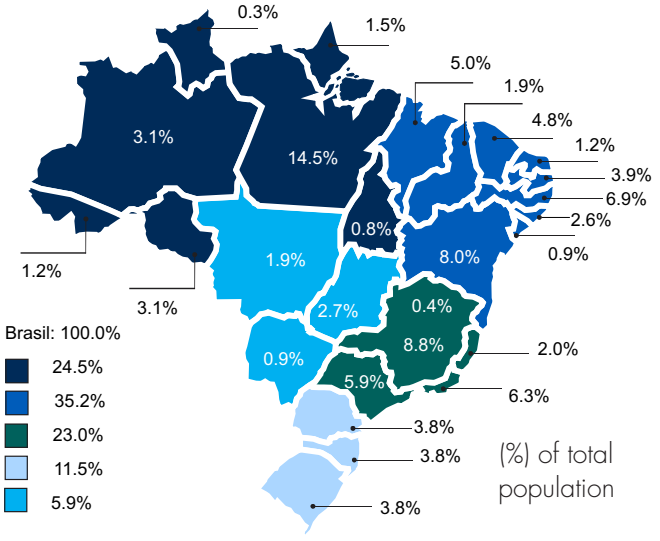
Map. 3.1
Number of dwellings deprived of access to treated water distribution system, 2022

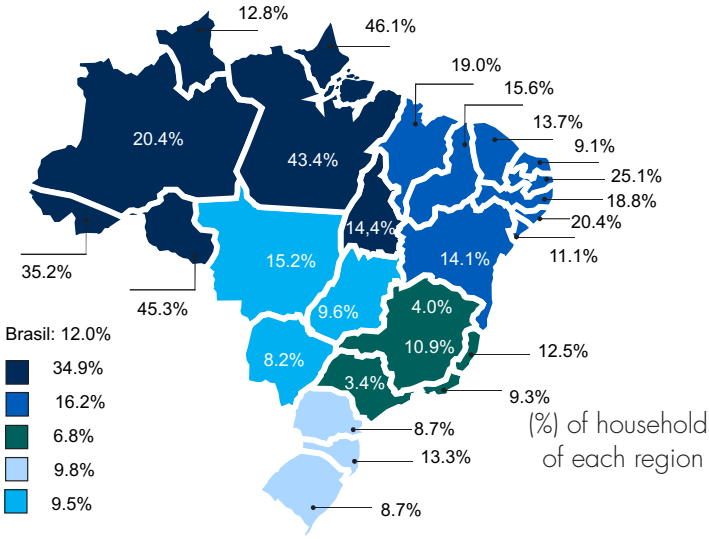


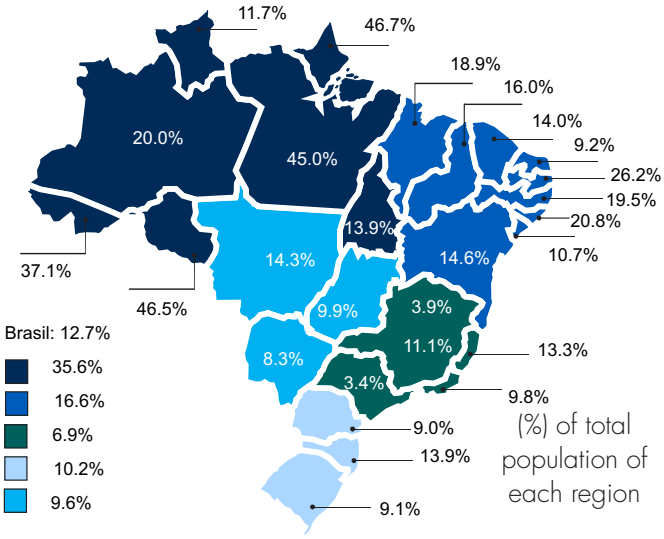
Map 3.2
Number of population deprived of access of treated water distribution system, 2022











Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Table 3.1
Distribution of dwellings and population by rural and urban areas and portions of dwellings and populations deprived of access to treated water distribution system, Brazil, 2022

	Urban	Rural	Total
		Dwellings	
(%) of deprived homes out of total homes	35.8%	64.2%	100.0%
% of dwellings	4.9%	61.1%	12.0%
		Population	
(%) of deprived population out of total population	51.5%	48.5%	100.0%
(%) of population in each area	13.4%	12.1%	12.7%

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

In the North Region, the problem was equally severe, with 6.688 million people living in homes without access to a treated water supply. This figure represents 24.5% of the national population in this situation. In this case, the share of these people in the total population was even higher than in the Northeast Region, with 36 out of every 100 people living in households without access to a water network in 2022. In the North Region, the most critical situation was in the states of Rondônia, Pará, and Roraima, where more than 45% of the population still lacked access to the general water network.

Of the total number of Brazilian dwellings lacking access to a treated water distribution network, 35.8% were in urban areas and 64.2% in rural areas, suggesting that homes in rural areas are more inadequate. This is supported by the fact that six in every ten rural homes in Brazil lacked access to a treated water distribution system. In demographic terms, however, the distribution was quite different: 51.5% of the population without access to the water network lived in the urban areas of Brazilian cities, while only 48.5% of people in this situation were in rural areas. Accordingly, the percentage of the total population in each region that lacked access to the general treated water network ended up being slightly higher among urban dwellers.

3.2. Changes over time

In the case of deprivation of access to the general treated water supply network, consistent historical information begins in 2016. From that year to 2022, the number of homes facing this type of deprivation fell from 9.567 million to 8.916 million, indicating that 651,000 homes are no longer deprived of this utility. The rate of decline was low, at just 1.2% per year, accumulating to a 6.8% reduction between 2016 and 2022 in the number of homes lacking access to the general treated water supply network. In relative terms, the percentage of deprived dwellings fell from 14.2% of all dwellings in 2016 to 12.0% of all dwellings in the country in 2022. This amounted to a reduction of 2.2 percentage points.

In population terms, historical data points to a slight downward trend in the number of people without access to the water network. Between 2016 and 2022, the number of people in deprivation fell from 31.024 million to 27.270 million, indicating that more than 3.754 million people were no longer deprived of this basic sanitation service. The rate of decline was 2.1% per year, accumulating a 12.1% reduction between 2016 and 2022 in the number of people living in homes lacking access to the

Chart 3.1
Evolution of housing deprived of access to treated water distribution system, Brazil

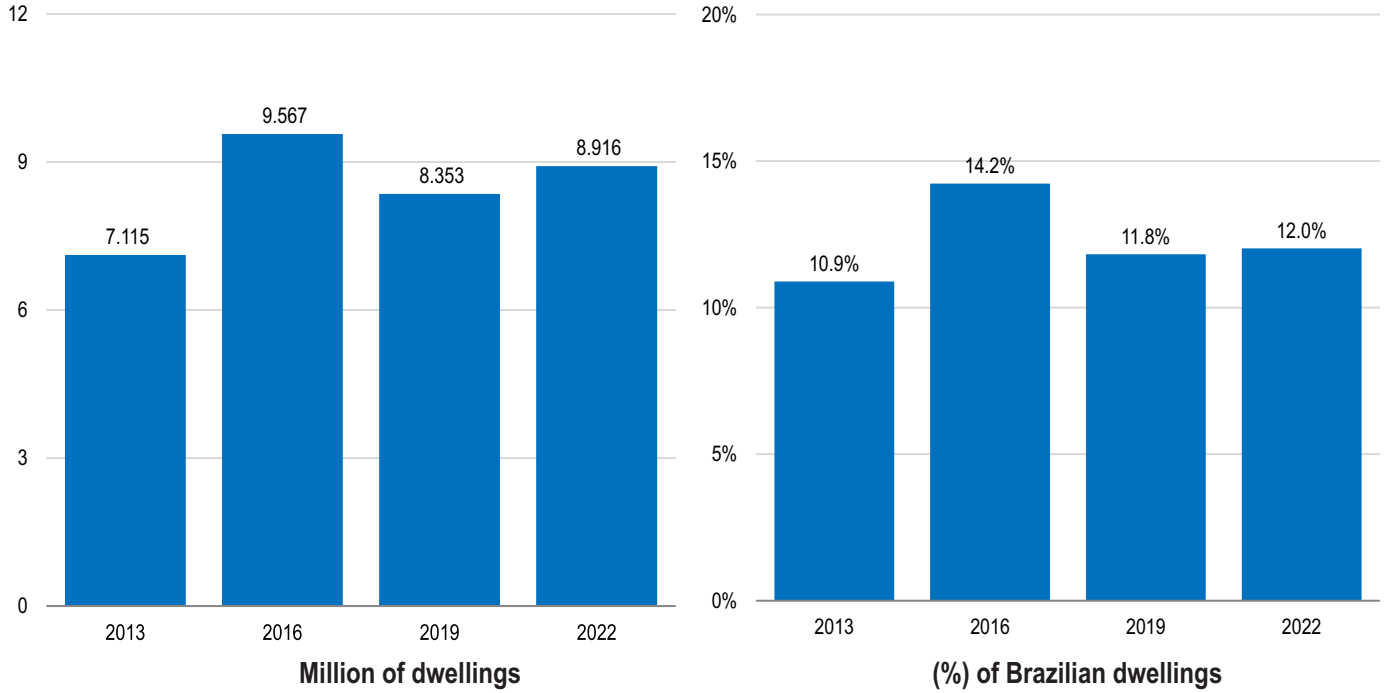
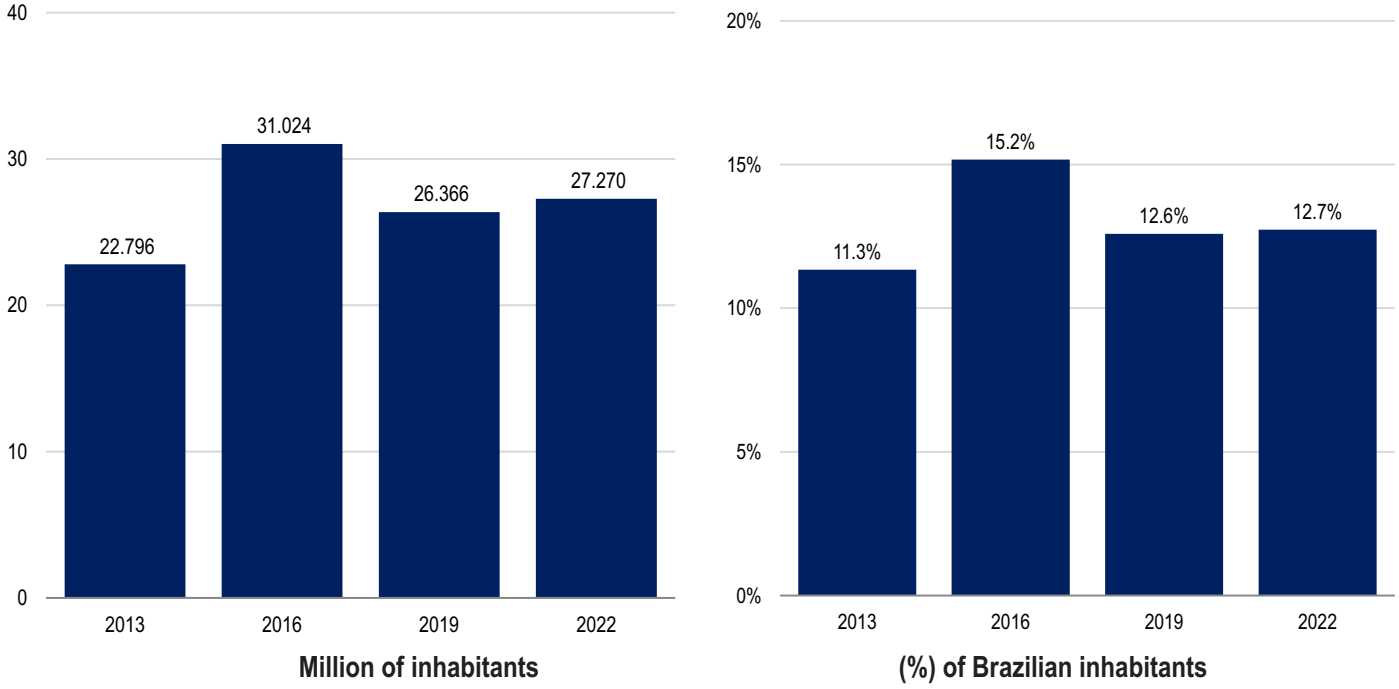


Chart 3.2
Evolution of population deprived of access to treated water distribution system, Brazil



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

general water distribution network. In relative terms, the percentage of people in deprivation fell from 15.2% of the Brazilian population in 2016 to 12.7% of Brazilians in 2022.

3.3. Profile of deprived homes

Most dwellings without a general treated water supply were houses (97.5%). Apartments with this characteristic accounted for only 2.3% of the total 8.916 million dwellings with this type of deprivation in 2022, and rooming houses for 0.2%. However, this deprivation was relatively higher in rooming houses: 16 out of every 100 dwellings of this type were deprived of this utility. In the case of houses, 14 out of every 100 were in this condition in 2022 and among apartments, only 2 out of every 100.

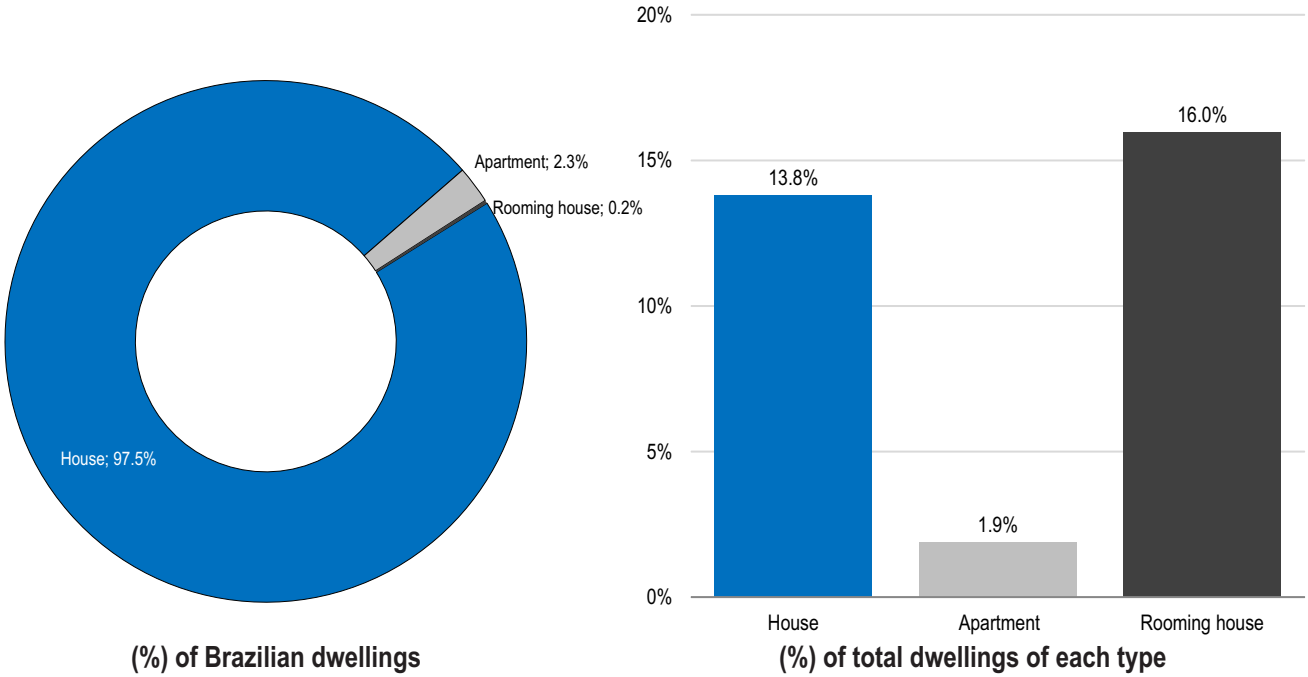
Graph 3.4 shows that the problem of lack of access to the general treated water supply network was more acute among dwellings with inadequate finishing materials. For example, of all the houses made of rammed earth, 47.4% had no access to the mains water supply. The relative rates exceeded 35% in houses made of wood and other materials. Only 10.1% of coated masonry houses did not have access to mains water.

When the roofing material of the houses is considered, the qualitative issue is repeated. The proportion of dwellings lacking access to the general treated water network was relatively higher in dwellings with metal tile roofs or other types of roofs, such as scavenged wood and thatch. This deprivation was much less frequent in houses with concrete-slab and tiled roofs.

In dwellings with dirt floors, the proportion of homes without access to the mains was extremely high (54.9%). In dwellings with wooden or cement floors, the percentage of homes with this type of deprivation was also relatively high: 14.2% and 30.1%, respectively.

The issue of lack of access to treated water is related to another major health problem, which is the way

Chart 3.3
Distribution of dwellings with deprivation of access to treated water distribution system by type of housing and relative frequency, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 3.4
Relative frequency of dwellings with lack of access to treated water distribution system, by wall material, Brazil, 2022

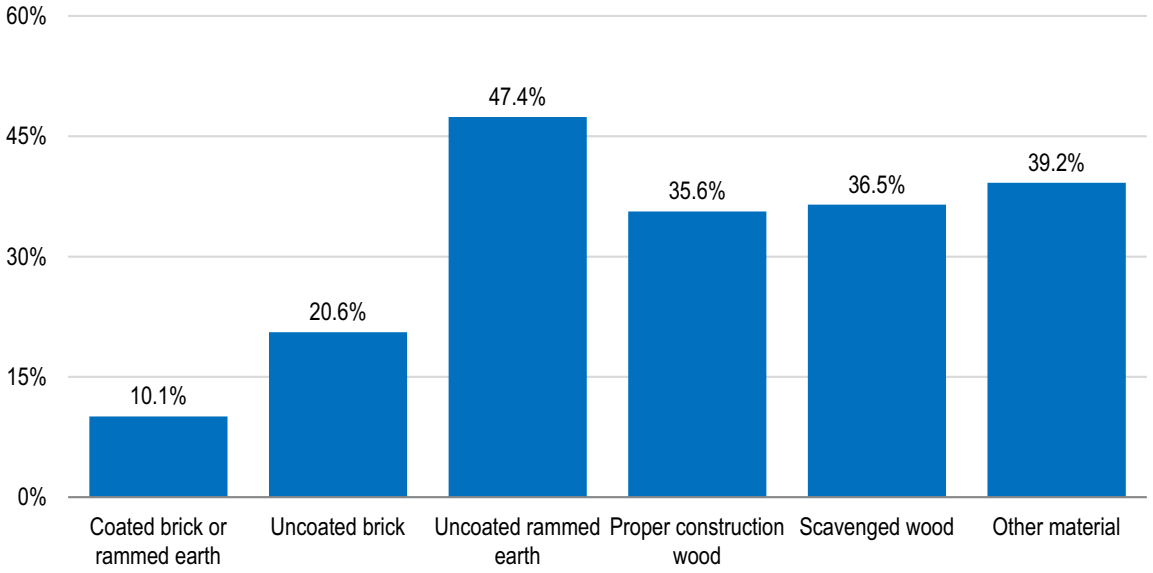
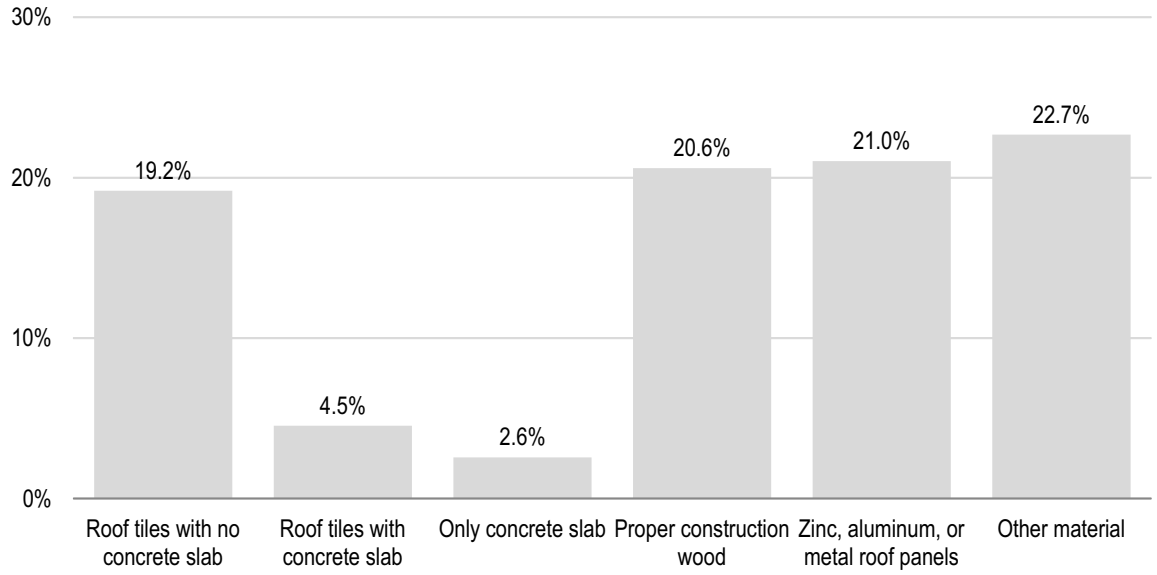


Chart 3.5
Relative frequency of dwellings with lack of access to treated water distribution system, by roofing material, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 3.6
Relative frequency of dwellings with lack of access to treated water distribution system by floor material, Brazil, 2022

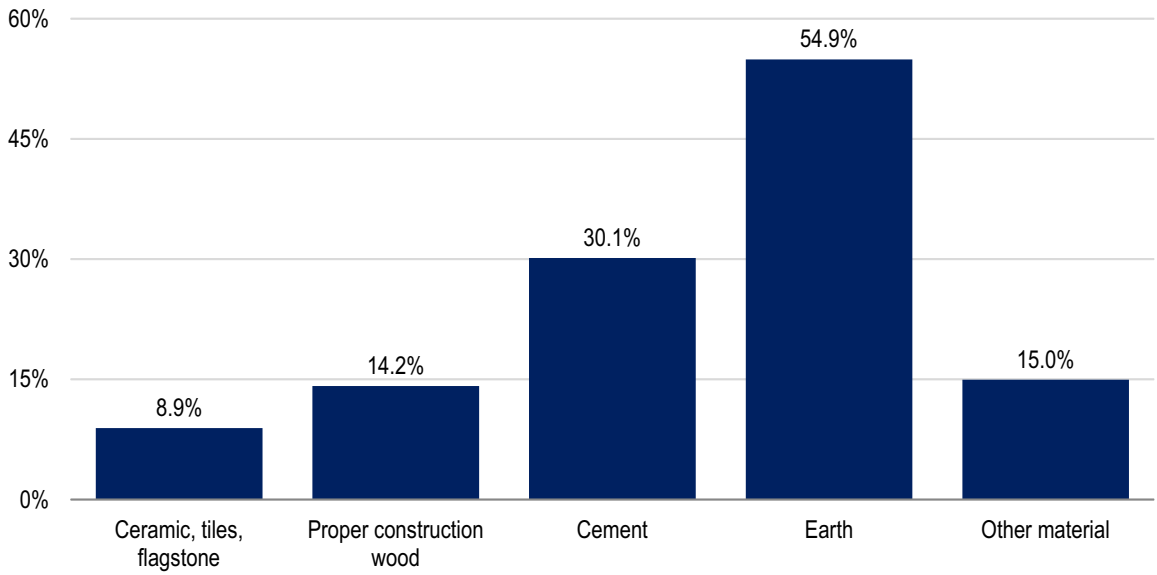
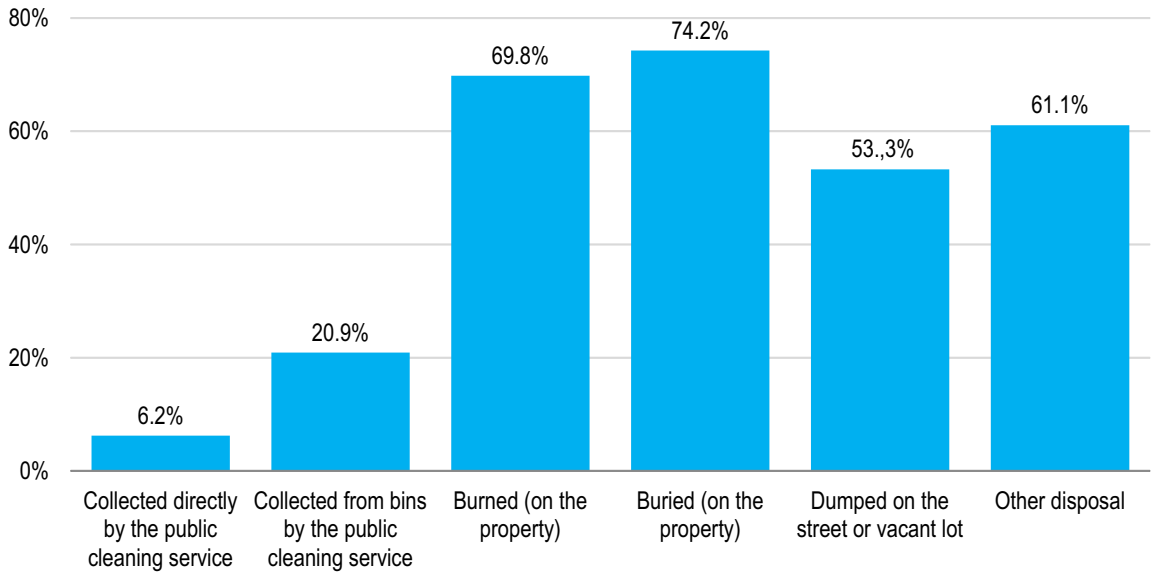


Chart 3.7
Relative frequency of dwellings with lack of access to treated water distribution system by waste destination, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

waste is collected. This meant that the proportion of households lacking access to a treated water distribution network was relatively higher in households where waste was dumped on a vacant lot (53.3%), buried on the property (74.2%) or burned on the property (69.8%). In homes where garbage is collected directly or is collected in bins by the public cleaning service, the problem of lack of access to the water network was less frequent.

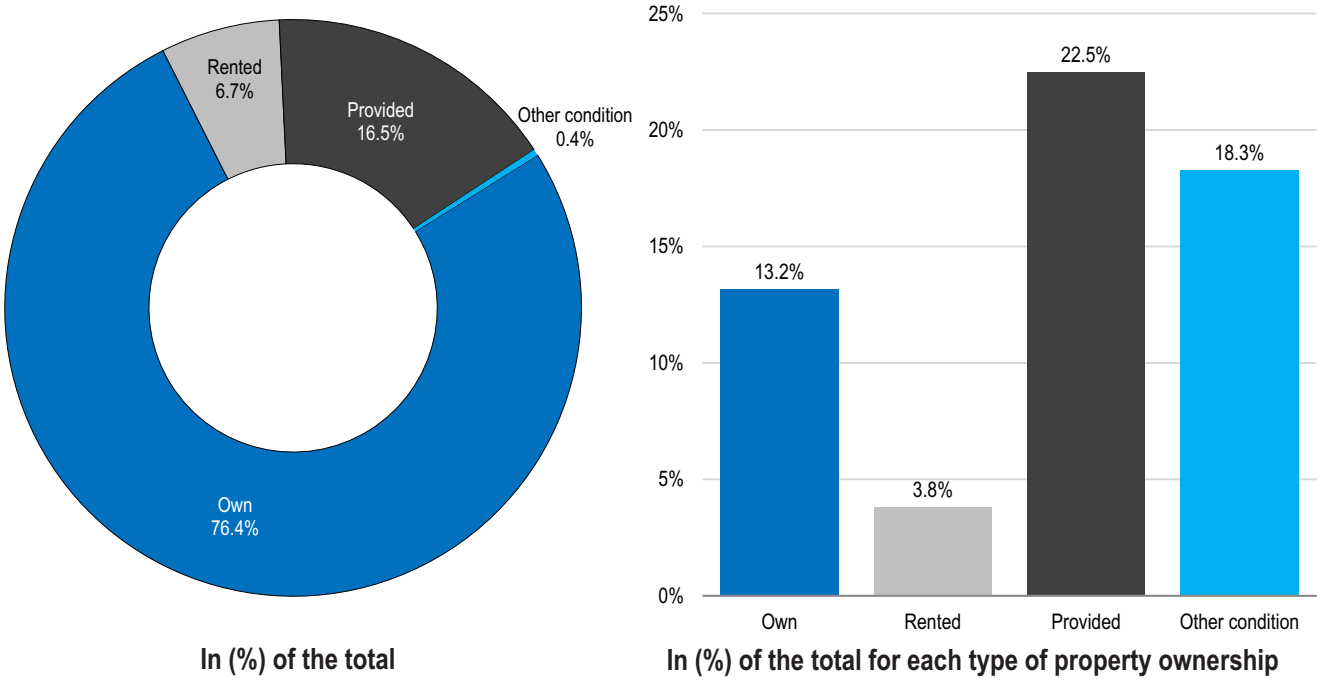
Most dwellings lacking access to treated water were owner-occupied (76.4%) and another high proportion were rented (16.5%). However, a higher relative frequency of dwellings with water deprivation was identified in dwellings provided by an employer. A total of 22.5% of employer-provided dwellings were not connected to the general treated water supply network, while in the case of owned dwellings, this rate was 13.2%.

3.4. Deprived population profile

Of the 27.270 million people living in dwellings lacking access to the general water network in 2022, 51.5% were men and 48.5% were women. In relative terms, the frequency of men in this housing condition was 13.4% and the frequency of women was 12.1%, resulting in a weighted average frequency of 12.7% of the total population.

The relative frequency of the population lacking access to the general water network was relatively constant across the different age groups. It should be noted, however, that this frequency was slightly higher in the younger age groups. Among the population aged up to 4 years, 14.2% lived in dwellings with no access to the general water network. This rate changes from the 20 to 29-year-old age group, reaching 11.0% for the demographic group aged 80 and over. For this reason,

Chart 3.8
Distribution of dwellings with deprivation of access to treated water distribution system by property ownership and relative frequency, Brazil, 2022



In (%) of the total

In (%) of the total for each type of property ownership

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

more than 30% of the 27.270 million people living in dwellings lacking access to the general treated water network were under 20 years old, which means that this problem was heavily concentrated among the country's young population and in families with a larger number of children.

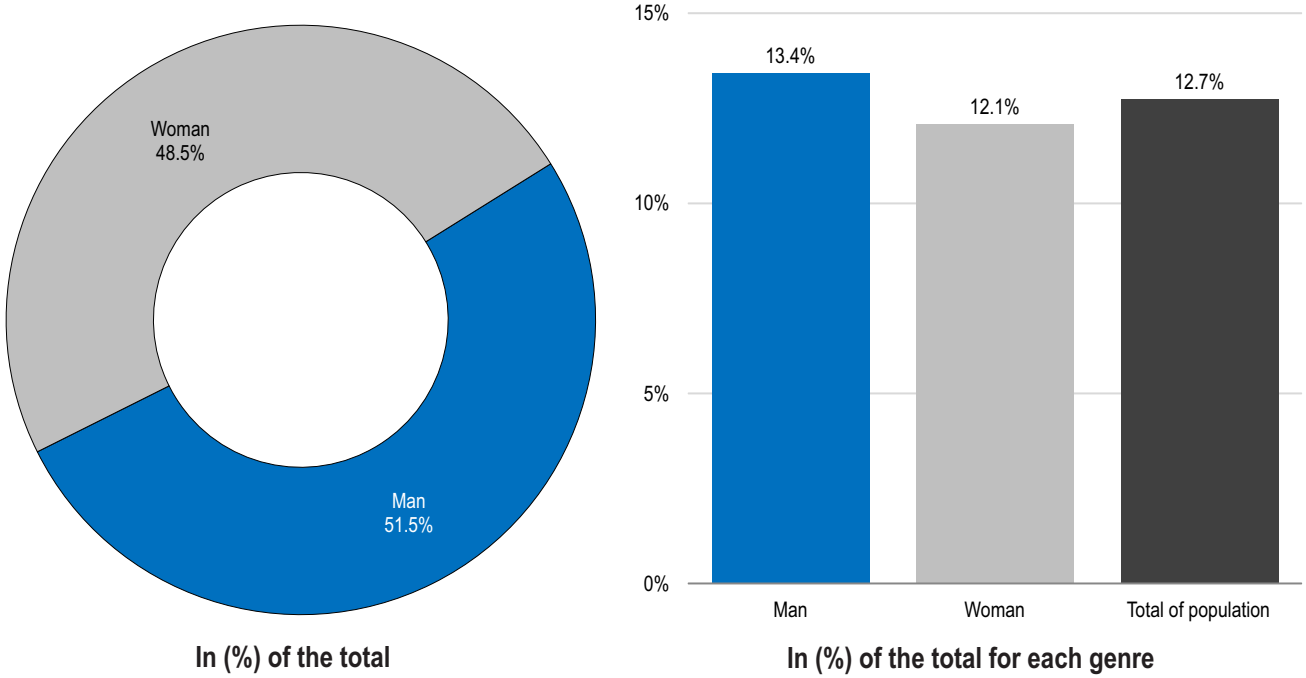
Self-declared brown individuals prevailed in the total population deprived of access to the general water supply network, accounting for 56.7% of the total in 2022. The self-declared white population accounted for 32.8% and the self-declared black population another 9.2%. In relative terms, however, the highest frequency occurred in the indigenous population, where 19 out of every 100 people were deprived of access to treated water. The frequency is also higher in the brown demographic group (15.9%).

From an educational point of view, most of the population deprived of access to treated water had no formal education (12.0%) or had not completed elementary school (45.8%). The proportion of the population who had reached higher education, whether they had completed this cycle, was relatively small, at 6.6% of the total number of people who were deprived of access to the general water distribution network.

The relative frequency of the population lacking access to the general water network varied greatly according to level of education. This frequency was higher in the less educated groups. Among the uneducated population, 19.2% lived in dwellings without access to the mains. This rate gradually fell in the more educated populations, reaching 4.3% for the demographic group with complete higher education.

The distribution of the population without access to the general water network by monthly household income bracket shows a strong concentration of low-income households. In 2022, 46.9% of the total of 27.270 million people with this deprivation lived in households where the total income was at most

Chart 3.9
Distribution of the population deprived of access to treated water distribution system by gender and relative frequency, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 3.10
Relative frequency of the population deprived of access to treated water distribution system, by age group, Brazil, 2022

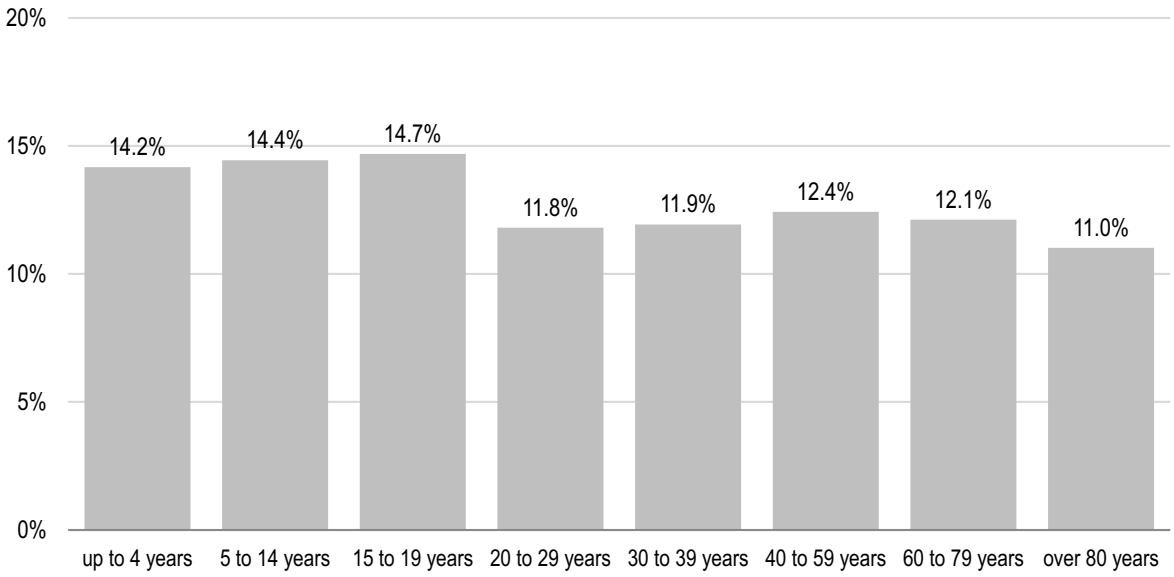
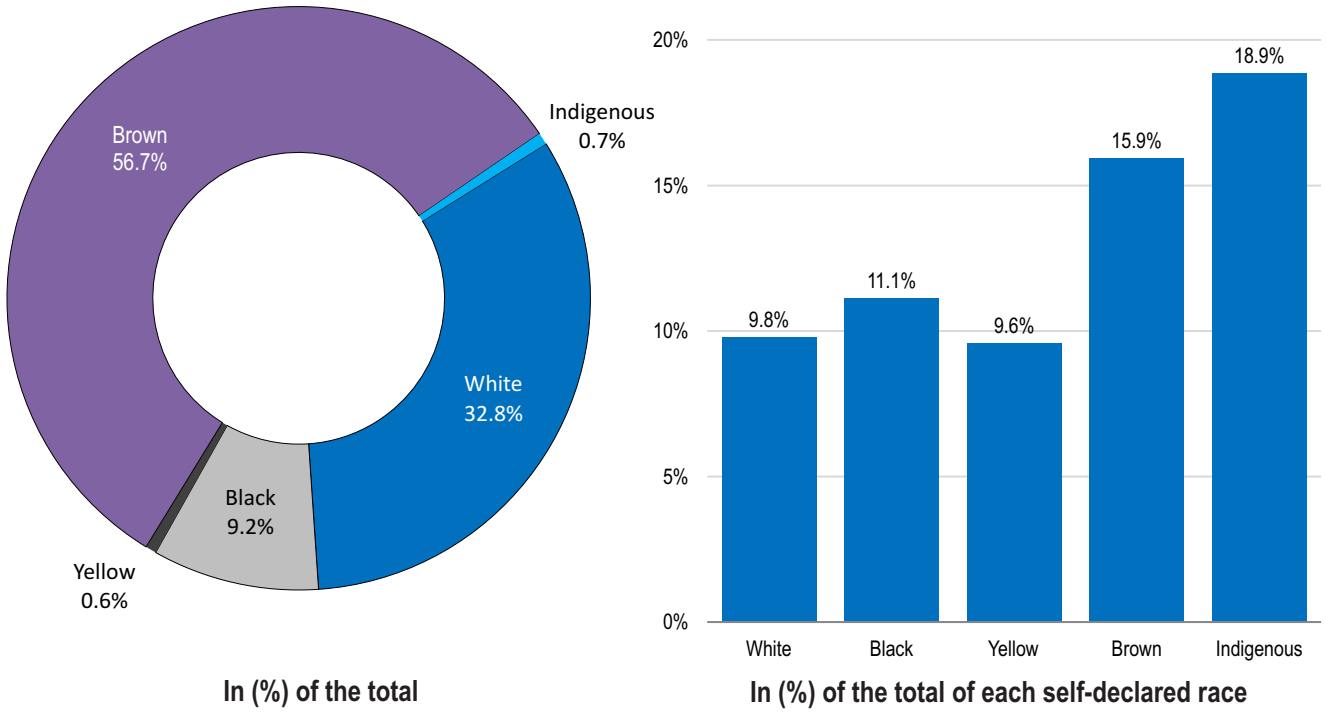
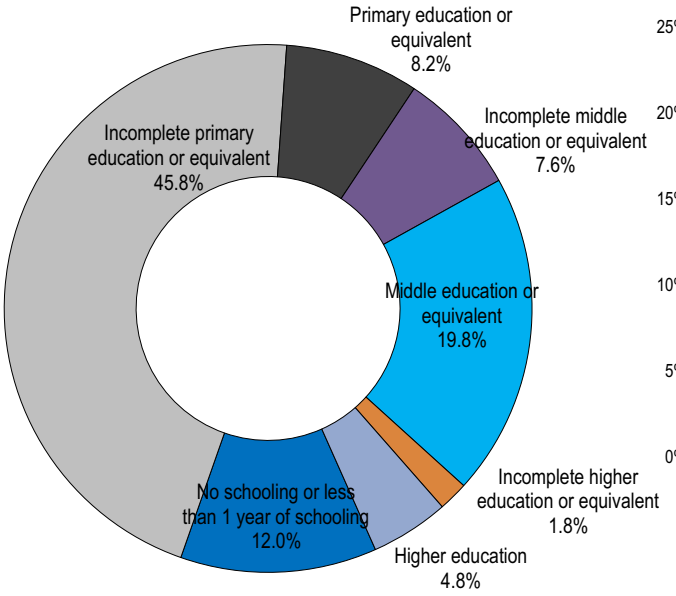


Chart 3.11
Distribution of the population deprived of access to treated water distribution system by self-declared race and relative frequency, Brazil, 2022

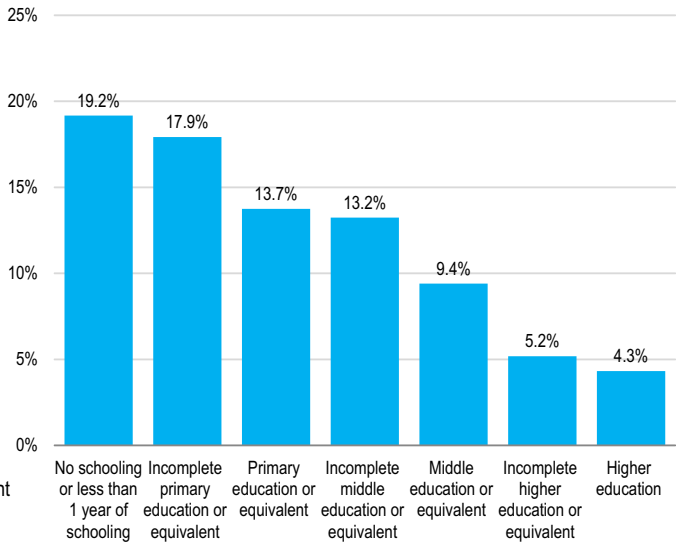


Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 3.12
Distribution of the population deprived of access to treated water distribution system by level of education and relative frequency, Brazil, 2022

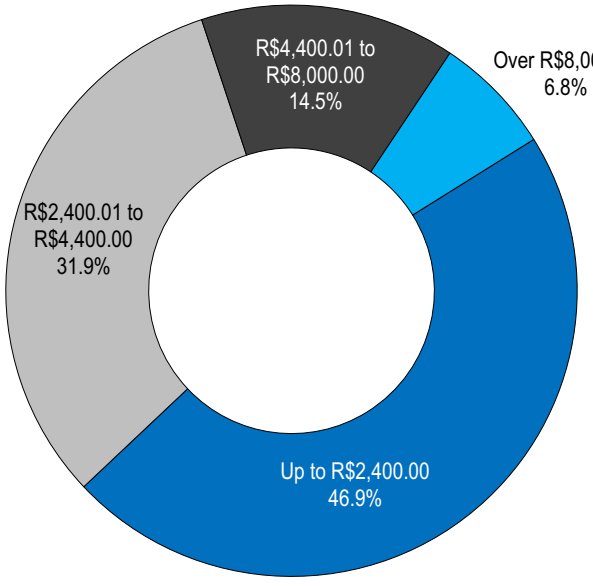


In (%) of the total

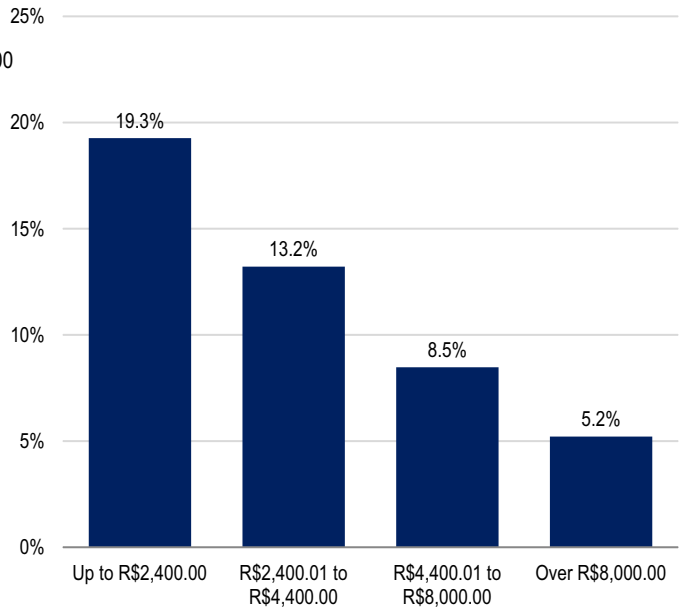


In (%) of the total of each level of education

Chart 3.13
Distribution of the population deprived of access to treated water distribution system by household monthly income range and relative frequency, Brazil, 2022



In (%) of the total



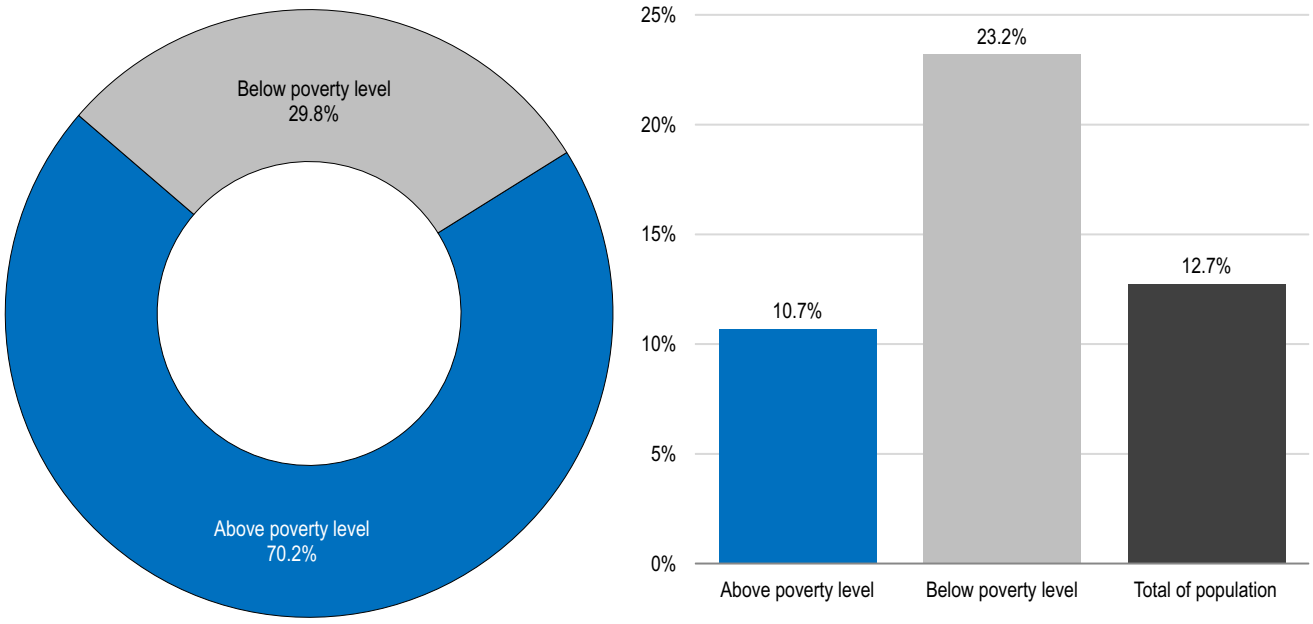
In (%) of the total of each household monthly income range

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

R$2,400.00 per month. A further 31.9% of people in deprivation lived in households with a monthly income of between R$2,400.01 and R$4,400.00. These two income classes accounted for almost 80% of the population deprived of access to the general treated water distribution network.

Lastly, the analysis identified that 70.2% of the population living in dwellings without access to a treated water distribution network were above the poverty line in 2022. In terms of relative frequency, 23 out of every 100 people living below the poverty line lacked access to the general water supply network in 2022.

Chart 3.14
Distribution of the population deprived of access to treated water distribution system by degree of poverty and relative frequency, Brazil, 2022



In (%) of the total

In (%) of the total for each degree of poverty

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Where are the largest affected populations?

		in thousands of people
1	Pará	3,966
2	Minas Gerais	2,387
3	Bahia	2,186
4	Pernambuco	1,882
5	Rio de Janeiro	1,722
6	São Paulo	1,598
7	Maranhão	1,352
8	Ceará	1,296
9	Paraíba	1,064
10	Rio Grande do Sul	1,050
11	Paraná	1,046
12	Santa Catarina	1,030
13	Rondônia	847
14	Amazonas	834
15	Goiás	725
16	Alagoas	703
17	Espírito Santo	554
18	Piauí	526
19	Mato Grosso	524
20	Amapá	413
21	Acre	335
22	Rio Grande do Norte	331
23	Sergipe	253
24	Mato Grosso do Sul	232
25	Tocantins	224
26	Distrito Federal	122
27	Roraima	70

Where this problem is more common?

In (%) of population		
46.7%	Amapá	1
46.5%	Rondônia	2
45.0%	Pará	3
37.1%	Acre	4
26.2%	Paraíba	5
20.8%	Alagoas	6
20.0%	Amazonas	7
19.5%	Pernambuco	8
18.9%	Maranhão	9
16.0%	Piauí	10
14.8%	Mato Grosso	11
14.6%	Bahia	12
14.0%	Ceará	13
13.9%	Santa Catarina	14
13.9%	Tocantins	15
13.3%	Espírito Santo	16
11.7%	Roraima	17
11.1%	Minas Gerais	18
10.7%	Sergipe	19
9.9%	Goiás	20
9.8%	Rio de Janeiro	21
9.2%	Rio Grande do Norte	22
9.1%	Rio Grande do Sul	23
9.0%	Paraná	24
8.3%	Mato Grosso do Sul	25
3.9%	Distrito Federal	26
3.4%	São Paulo	27

4

WATER DELIVERY FREQUENCY

4.1. Regional distribution

In Brazil 16.896 million dwellings connected to the general distribution network did not receive water daily in 2022, as recommended by the World Health Organization and the National Sanitation Plan (Plansab). This figure represents 22.8% of all homes in the country.

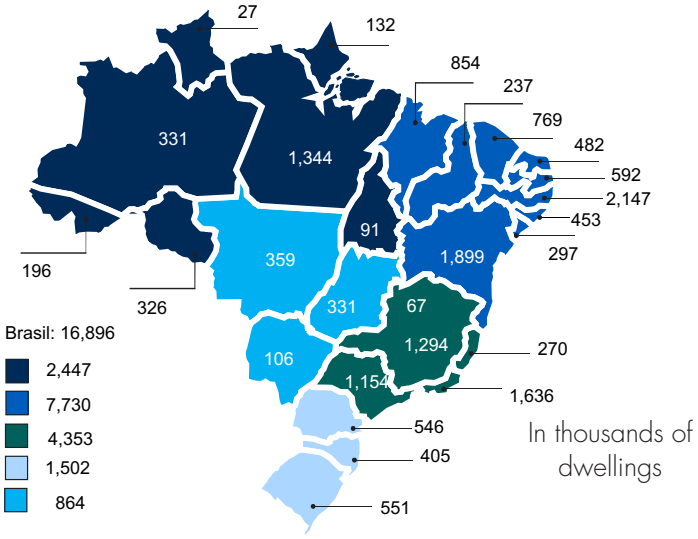
As seen in the other dimensions of sanitation deprivation, the majority of dwellings with this type of deprivation are located in the states of Brazil's Northeast Region, with a total of 7.73 million households in 2022, or 45.8% of the national total. Among these northeastern states, the highest concentration of homes with this deprivation was in Pernambuco, Bahia, and Maranhão, the same states with the highest number of homes lacking access to the treated water network. In the Northeast Region, 23 out of every 100 homes did not receive water daily. In three states, however, this proportion was very close to or passed the 40 per 100 mark, as was the case in Alagoas, Pernambuco, Paraíba, Rio Grande do Norte, and Maranhão.

The Southeast Region came second in the number of homes with irregular supply, concentrating 25.8% of homes with this type of deprivation in 2022. In total, there were 4.353 million dwellings in this situation. Incidence rates were highest in the state of Rio de Janeiro, where 1 in 4 households did not receive a regular supply of water, and in Espírito Santo, where 1 in 5 dwellings experienced supply problems.

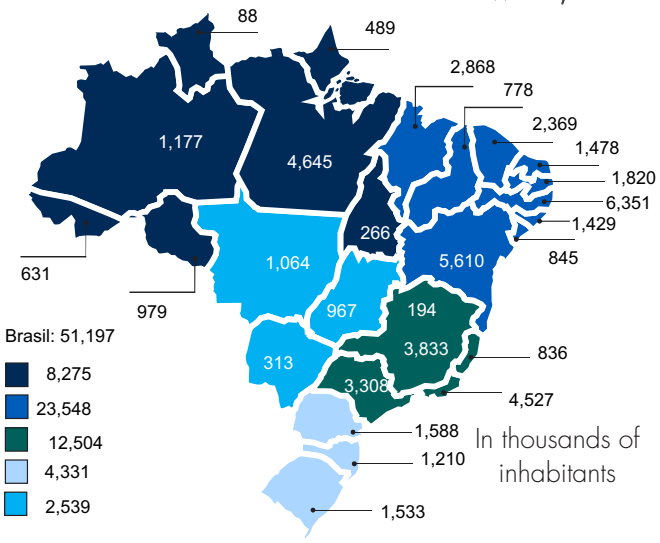
In the North Region, the problem was also very severe, with 2.447 million homes lacking a regular supply of water, or 14.5% of the national total. In this case, however, the share that these dwellings represent of the total number of dwellings was even higher than in the Northeast Region: 43 out of every 100 households did not have regular water supply in 2022. In relative terms, all the northern states faced problems, but the most severe were in Pará, where 51.1% of homes did not receive water regularly, Rondônia (52.1% of the state's population), Amapá (54.1%), and Acre (69.5%).

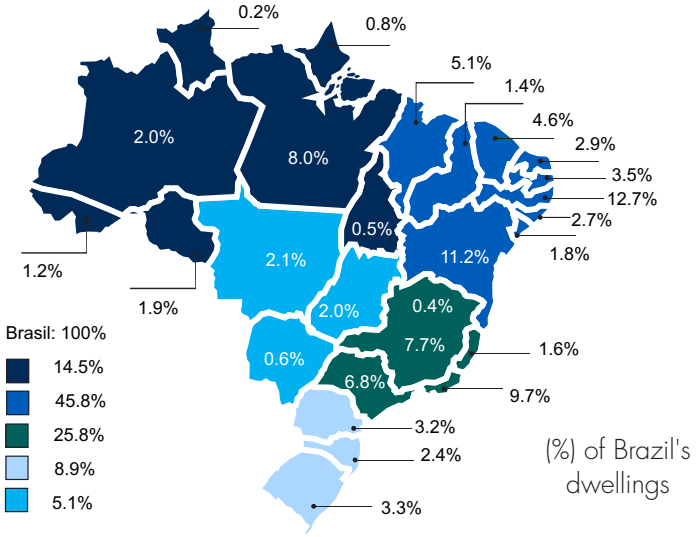
The number of Brazilians living in homes without a regular water supply in 2022 was 51.197 million people, which corresponded to 23.9% of the Brazilian population. In terms of population, most of the problem (46.0%) was also located in Brazil's northeastern states, totaling 23.548 million people in 2022. The highest concentration of people facing this deprivation was in the states of Pernambuco (6.351 million people), Bahia (5.610 million), Maranhão (2.861 million), and Ceará (2.369 million). In the state of Pernambuco, this situation was

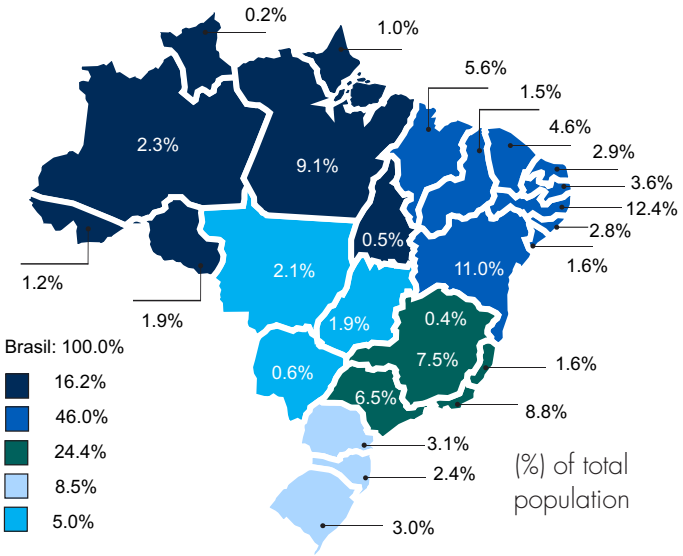
Map 4.1
Number of dwellings with irregular supply of treated water, 2022

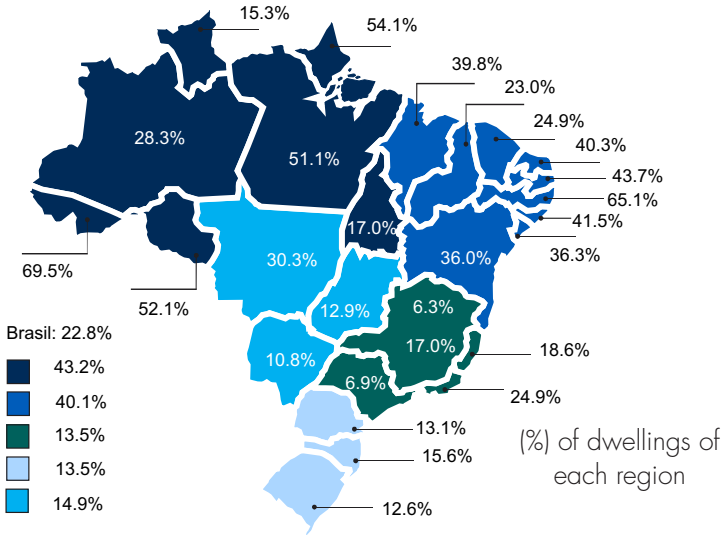


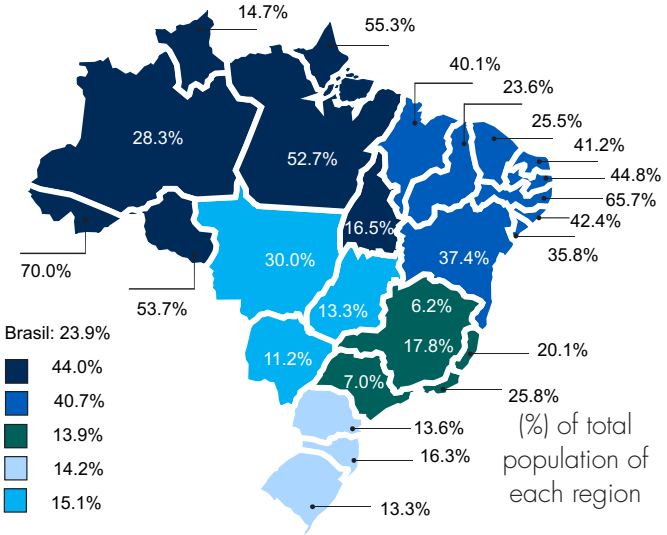
Map 4.2
Number of population with irregular supply of treated water, 2022











Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Table 4.1
Distribution of dwellings and population by rural and urban areas and portions of dwellings and populations with irregular supply of treated water, Brazil, 2022

	Urban	Rural	Total
		Dwellings	
(%) of deprived homes out of total homes	60.4%	39.6%	100.0%
% of dwellings	15.8%	71.3%	22.8%
		Population	
(%) of deprived population out of total population	50.2%	49.8%	100.0%
(%) of population in each area	24.5%	23.3%	23.9%

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

extremely serious, with 65 out of every 100 inhabitants still not receiving a regular supply of treated water in 2022.

The second largest demographic group with supply problems was in the Southeast Region, where 12.505 million people did not receive water regularly enough. This figure represents 24.4% of all people facing this situation in Brazil. In the state of Rio de Janeiro, there were 4.527 million people in this situation; in Minas Gerais, there were 3.833 million; and in São Paulo, 3.308 million people. In relative terms, the most serious water supply problem was in Rio de Janeiro, where around 1 in 4 inhabitants were deprived of a regular water supply in 2022. This proportion was also high in Espírito Santo (1 per 5 inhabitants).

In the North Region, there were 8.275 million people living in homes without regular access to treated water. This figure represents 16.2% of the national population. In this case, however, the share of these people in the total population was even higher than in the Northeast Region, with 44 out of every 100 people living in dwellings without access to regular water supply in 2022. In the North Region, the most critical were again the states of Rondônia, Pará, Amapá, and Roraima, where more than 45% of the population still received water on an irregular basis.

Of the total number of Brazilian homes that did not receive treated water every day, 60.4% were in urban areas and only 39.6% in rural areas, indicating a greater inadequacy of housing in the urban areas of Brazilian cities. This idea was corroborated by the fact that 24.5% of dwellings in the country's urban areas did not receive regular water supply, a higher proportion than in rural areas (23.3%). In terms of population, however, the distribution was different: half of the population without a regular supply lived in the urban areas of Brazilian cities and the other half in rural areas.

4.2. Changes over time

In the case of irregular supply of treated water, consistent historical information also begins in 2016. During the 2016-2022 period, the number of dwellings in this type of deprivation fluctuated, but did not show an upward change, since the number of dwellings in this situation in 2016 is practically the same as in 2022. In relative terms, as the total number of dwellings has grown in these six years, there has been a reduction in the percentage of deprived dwellings. The rate fell from 25.1% of all dwellings in 2016 to 22.8% of all dwellings in the country in 2022. This amounted to a reduction of 2.3 percentage points.

In population terms, historical data points to a slight downward trend in the number of people lacking a regular supply of treated water. Between 2016 and 2022, the number of people in deprivation fell from 54.099 million to 51.197 million, indicating that

Chart 4.1
Evolution of housing with irregular supply of treated water, Brazil

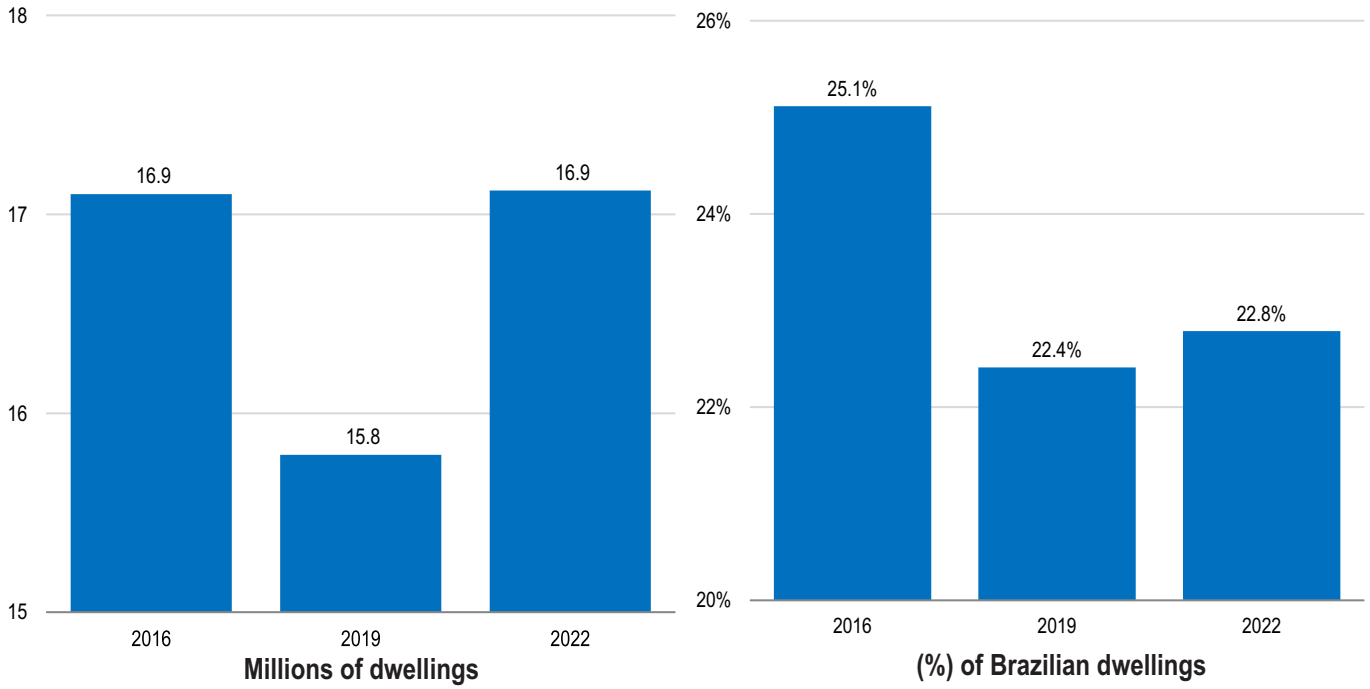
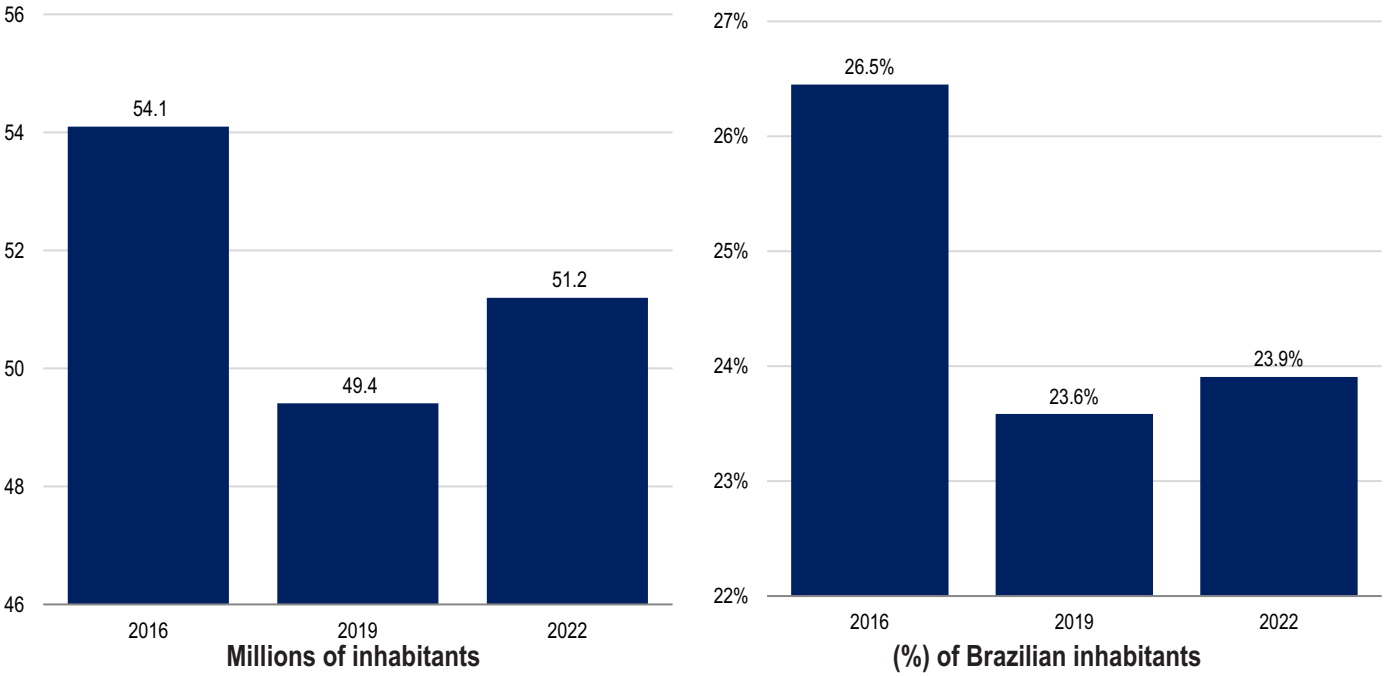


Chart 4.2
Evolution of population with irregular supply of treated water, Brazil



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

more than 2.902 million people were lifted out of the situation of deprivation of this basic sanitation service. The rate of decline was 1.8% per year, accumulating a 5.4% reduction between 2016 and 2022 in the number of people living in homes with an irregular supply of water. In relative terms, the percentage of people in deprivation fell from 26.5% of the Brazilian population in 2016 to 23.9% of Brazilians in 2022, a reduction of 2.5 percentage points.

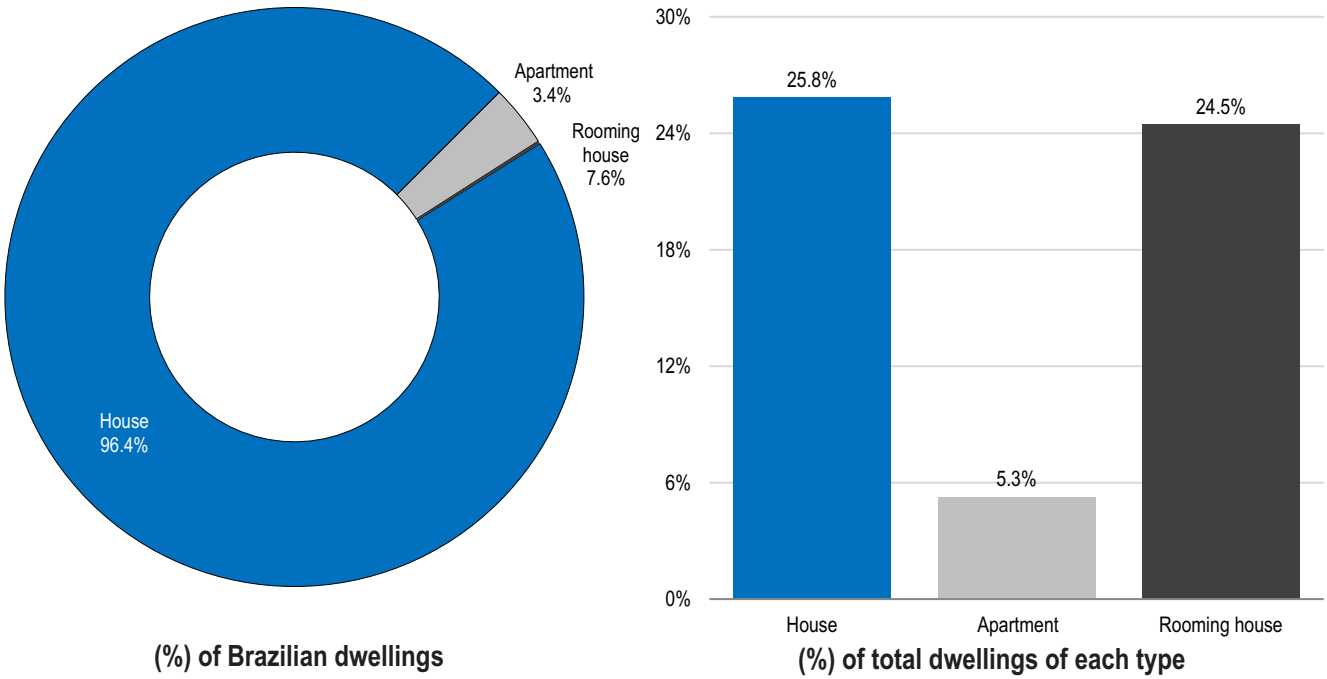
4.3. Profile of deprived homes

Irregular water supply is typically a problem that occurs in houses (96.4%). Apartments with this characteristic accounted for only 3.4% of the total 16.896 million dwellings with this type of deprivation in 2022, while rooming houses represented 0.2%. Despite its low share of the total, irregular water supply affects 1 in 4 room dwellings, a relative frequency close to that of house-type dwellings.

Most of the dwellings with irregular treated water supply problems were found among those with coated masonry walls (81.1%). In relative terms, however, the problem was more acute among houses with uncoated masonry, rammed earth or wooden walls. For example, 58.8% of all uncoated rammed earth houses had irregular water supply. The relative rates exceeded 40% in houses made of wood and 50% in those made of other materials. We should point out that uncoated masonry houses are common on the outskirts of large urban centers and in informal settlements or squatter communities, while rammed earth and wooden houses are more common in rural areas. Thus, the problem of irregular water supply is different from the phenomenon of lack of access to the general network, since the former is an urban phenomenon and is found in more densely populated cities.

When the material of the roof of the dwellings is considered, the issue of regular water supply showed a different pattern from the issue of lack of access to the water network. The relative frequency

Chart 4.3
Distribution of dwellings with irregular supply of treated water by type of housing and relative frequency, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 4.4
Relative frequency of dwellings with irregular supply of treated water by wall material, Brazil, 2022

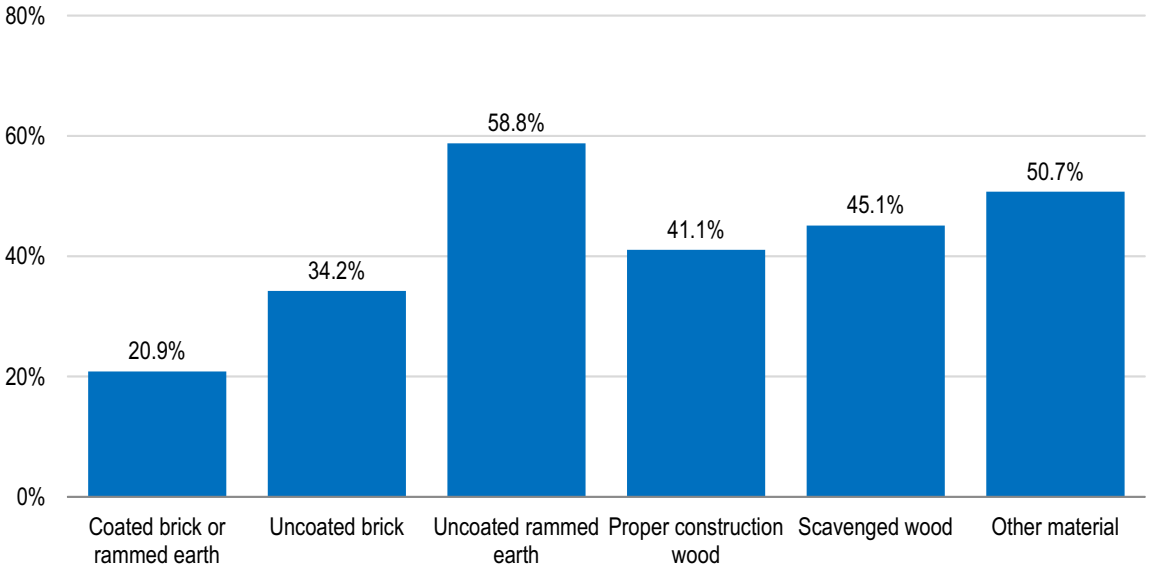
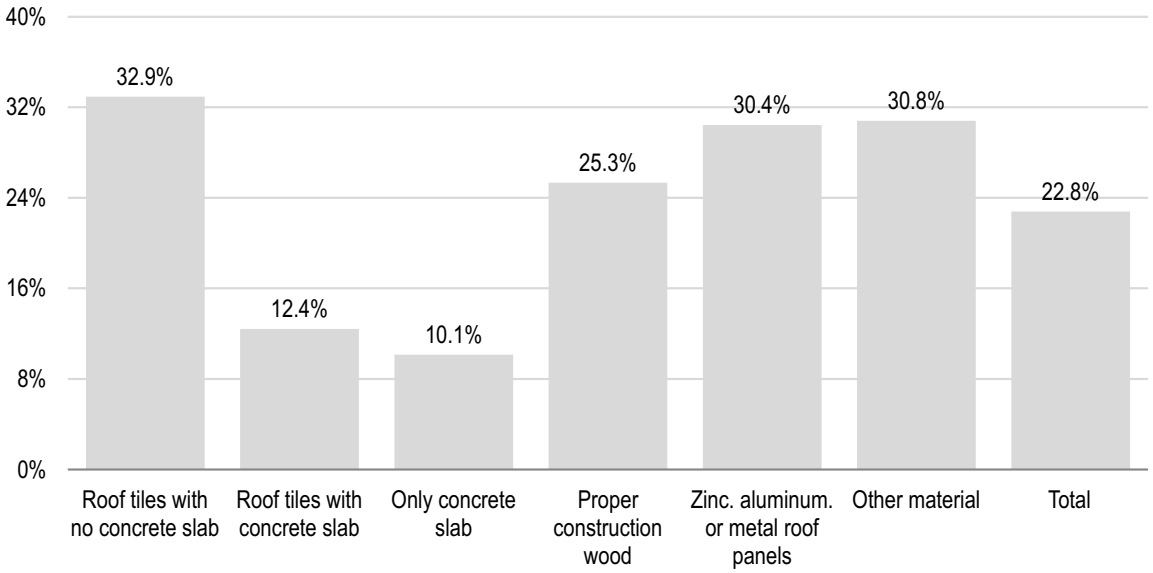


Chart 4.5
Relative frequency of dwellings with irregular supply of treated water by roofing material, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 4.6
Relative frequency of dwellings with irregular supply of treated water by floor material, Brazil, 2022

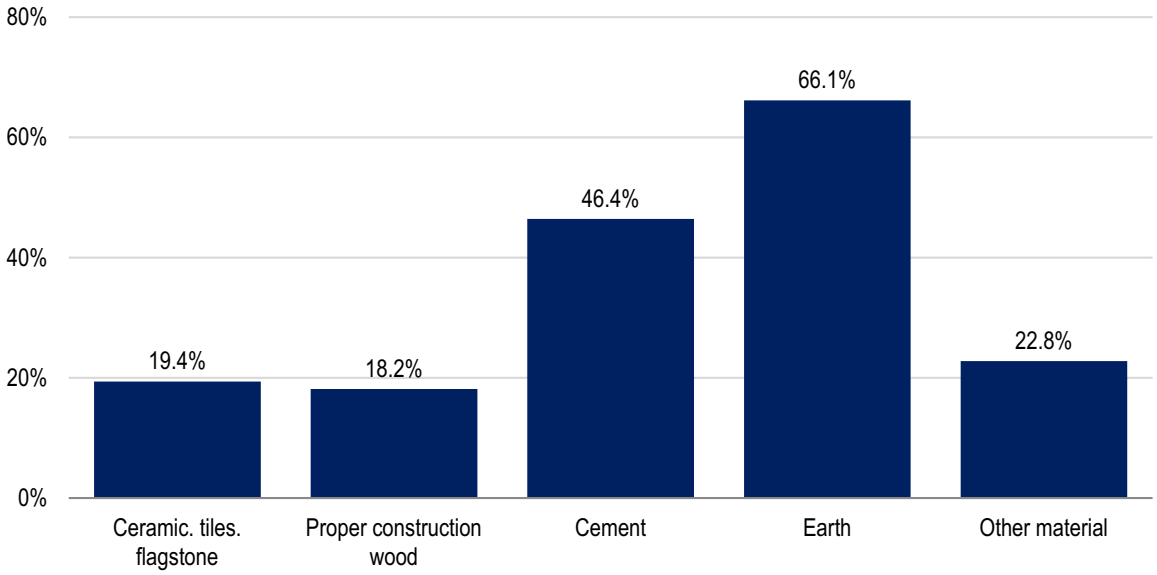
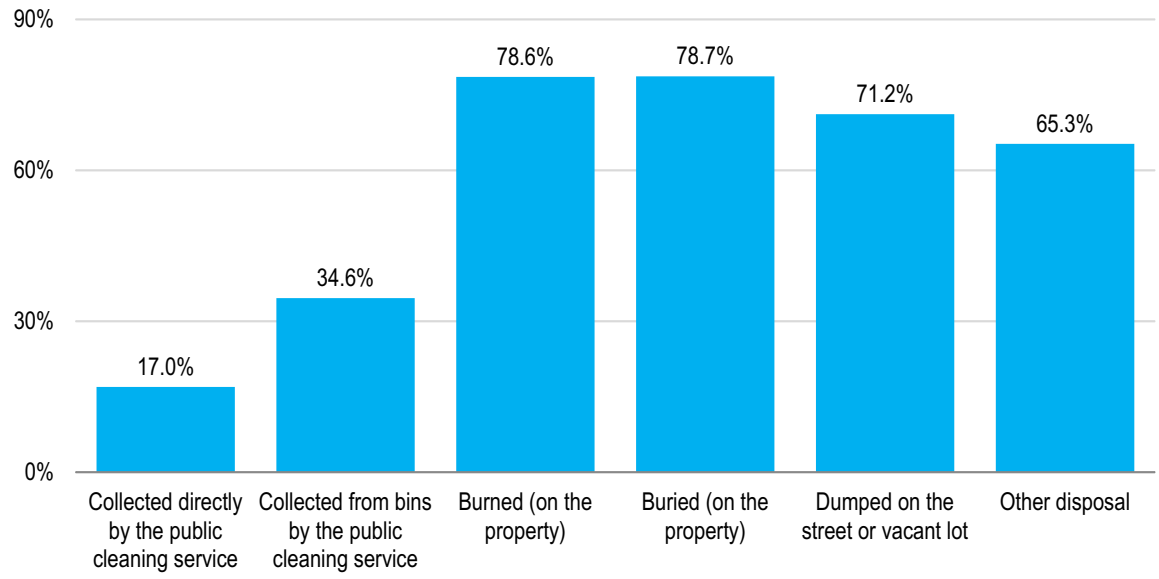


Chart 4.7
Relative frequency of dwellings with irregular supply of treated water by waste destination, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

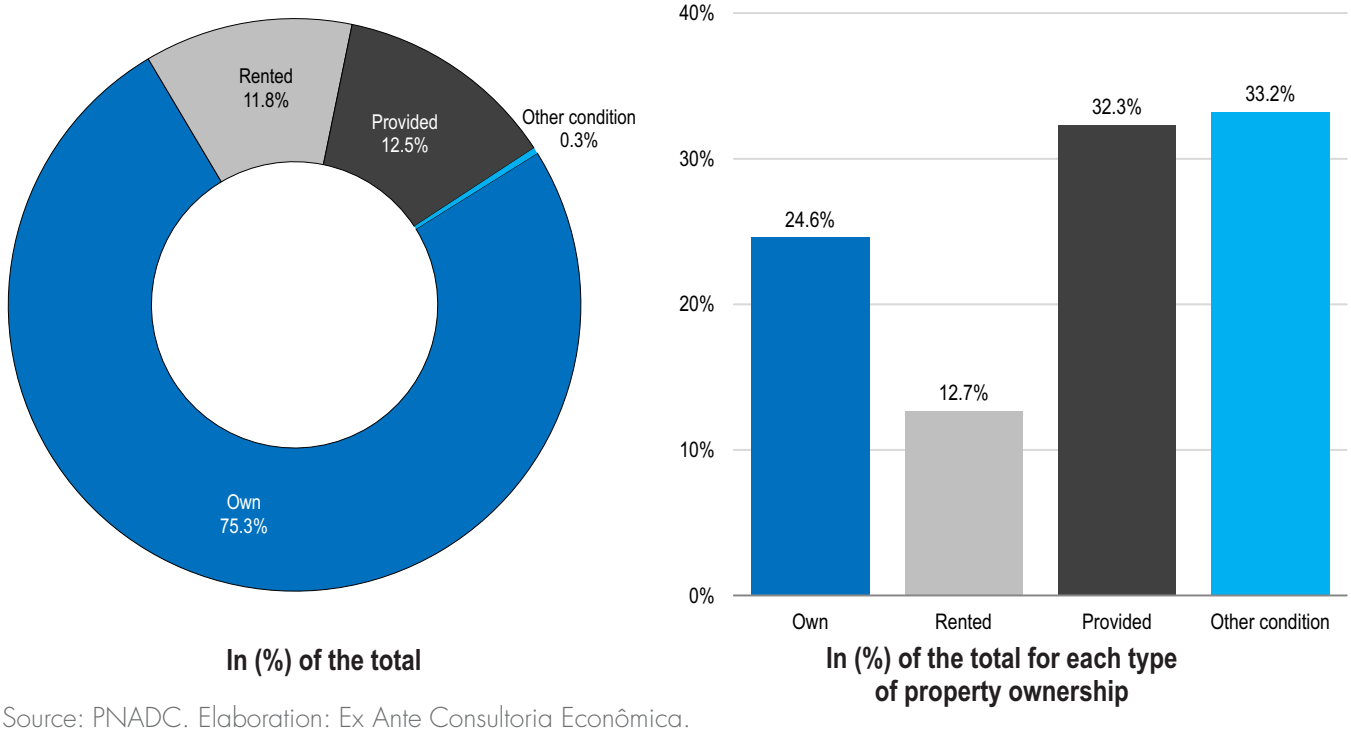
of dwellings lacking a regular supply of treated water was 32.9% among dwellings with tile roofs without concrete slabs. In the case of deprived access to the general treated water distribution system, this frequency was only 19.2%. The Irregular supply of water was much less frequent in houses with concrete-slab and tiled roofs.

As with the lack of access to the water network, the proportion of dwellings lacking regular supply was extremely high in dwellings with dirt floors: 66.1%. In dwellings with wooden or cement floors, the percentage of homes deprived of a regular supply of water was also relatively high: 14.2% and 30.1%, respectively.

Compared to households without access to the water network, the problem of irregular supply of treated water was even more related to the problem of how garbage is collected. This meant that the proportion of homes lacking a regular supply of water was relatively higher in dwellings where waste was dumped on a vacant lot (71.2%), buried on the property (78.7%), or burned on the property (78.6%). In homes where garbage is collected in bins by the public cleaning service, the problem of irregular water supply was more frequent than the problem of having access to the general treated water distribution system, 34.6% against 20.9%.

As was also observed in the case of deprivation of access to the general water network, the vast majority of dwellings without a regular supply of treated water were owned dwellings (75.3%) and the second highest proportion were rented dwellings (12.5%). A higher relative frequency of dwellings with water deprivation was also identified in dwellings provided by an employer. A total of 32.3% of such housing lacked a regular supply of treated water. In the case of owned housing, this rate was lower, 24.6%.

Chart 4.8
Distribution of dwellings with irregular supply of treated water by property ownership and relative frequency, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

4.4. Deprived population profile

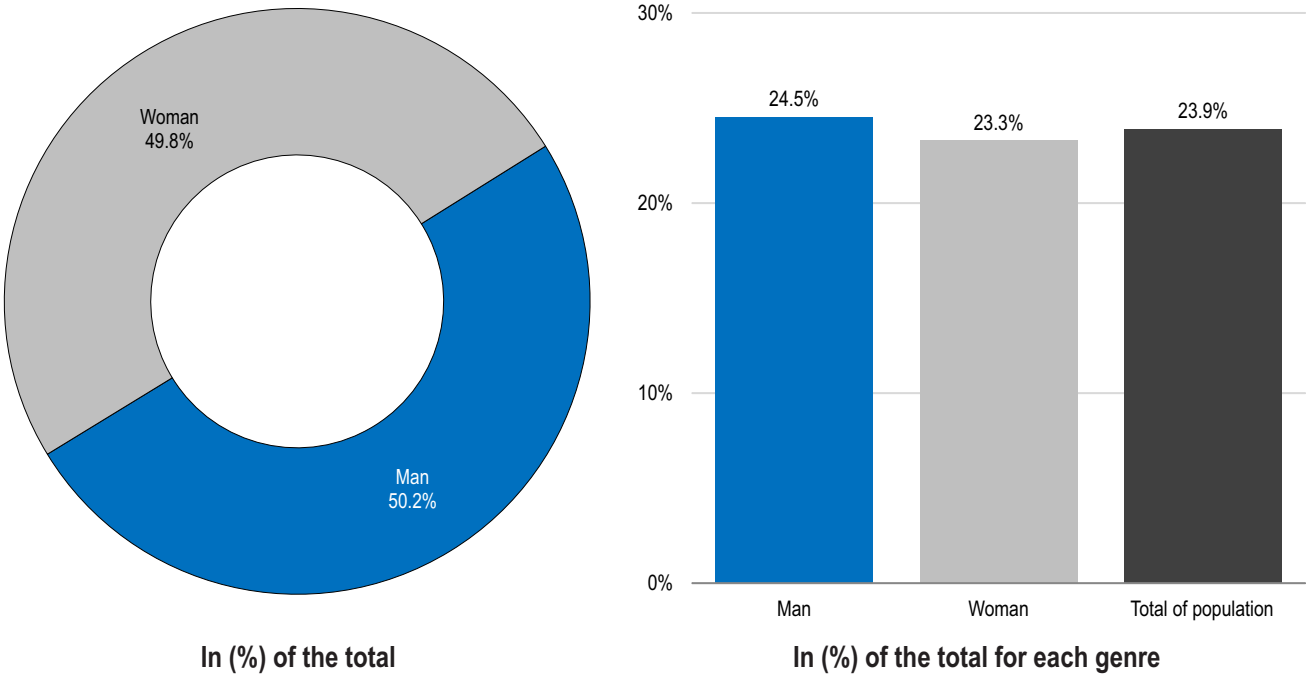
The gender distribution of the population living in dwellings with irregular water supply was approximately 50% female and 50% male. In relative terms, the frequency of men in this housing condition was 24.5% and the frequency of women was 23.3%, resulting in a difference of 1.2 percentage points. The weighted average was 23.9% of the total population.

The relative frequency of the population with irregular water supply also varied little between the different age groups, but was slightly higher in the younger age groups. Among the population aged up to 4 years, 25.8% lived in dwellings with no access to the general water network. This rate increased up to the population aged 15 to 19. In the next age group, the rate changed to 23%. In the demographic group aged 80 and over, it reaches its lowest level: 20.5% of the total population in this age group. Thus, 30.4% of the 51.197 million people living in dwellings with an irregular supply of treated water were under the age of 20, another problem that is also heavily concentrated among the country's young population and in families with a larger number of children.

Self-declared brown people also prevailed in the total population deprived of access to the general water supply network, accounting for 55.9% of the total in 2022. The self-declared white population accounted for 32.0% and the self-declared black population another 10.8%. In relative terms, however, the highest frequency occurred in the indigenous population, where 33 out of every 100 people were deprived of regular access to treated water. The frequency is also higher in the brown demographic group (29.5%).

As was observed in the case of deprivation of access to treated water, most of the population in a state of irregular supply of treated water either had no formal education (11.2%) or had not completed elementary school (41.0%). The proportion of the population who had reached higher education, whether they

Chart 4.9
Distribution of the population with irregular supply of treated water by gender and relative frequency, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 4.10
Relative frequency of the population with irregular supply of treated water by age group, Brazil, 2022

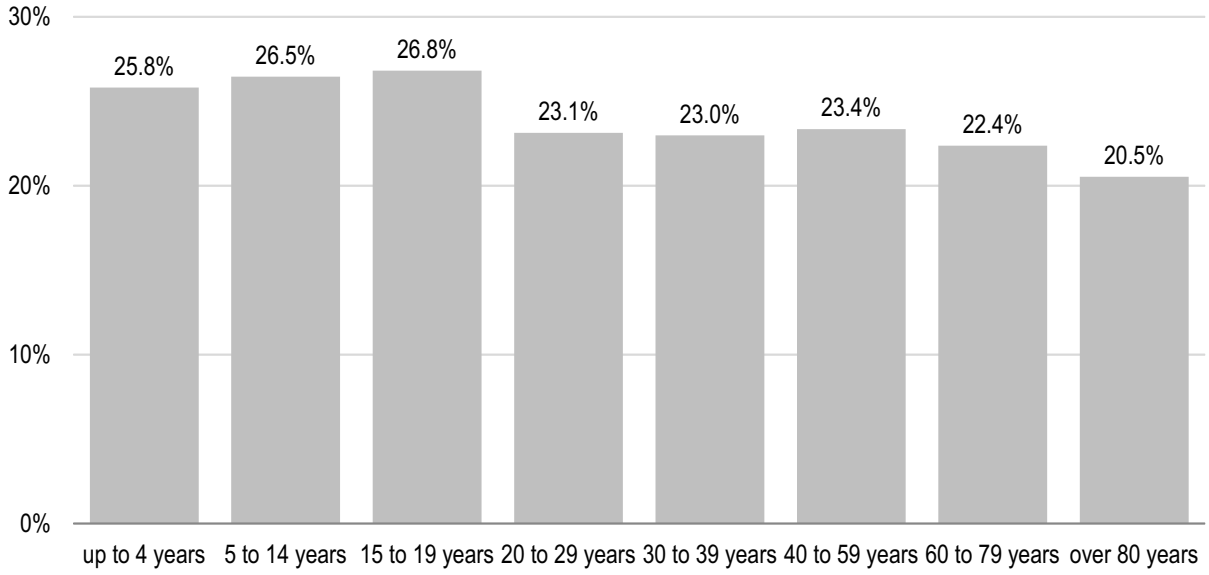
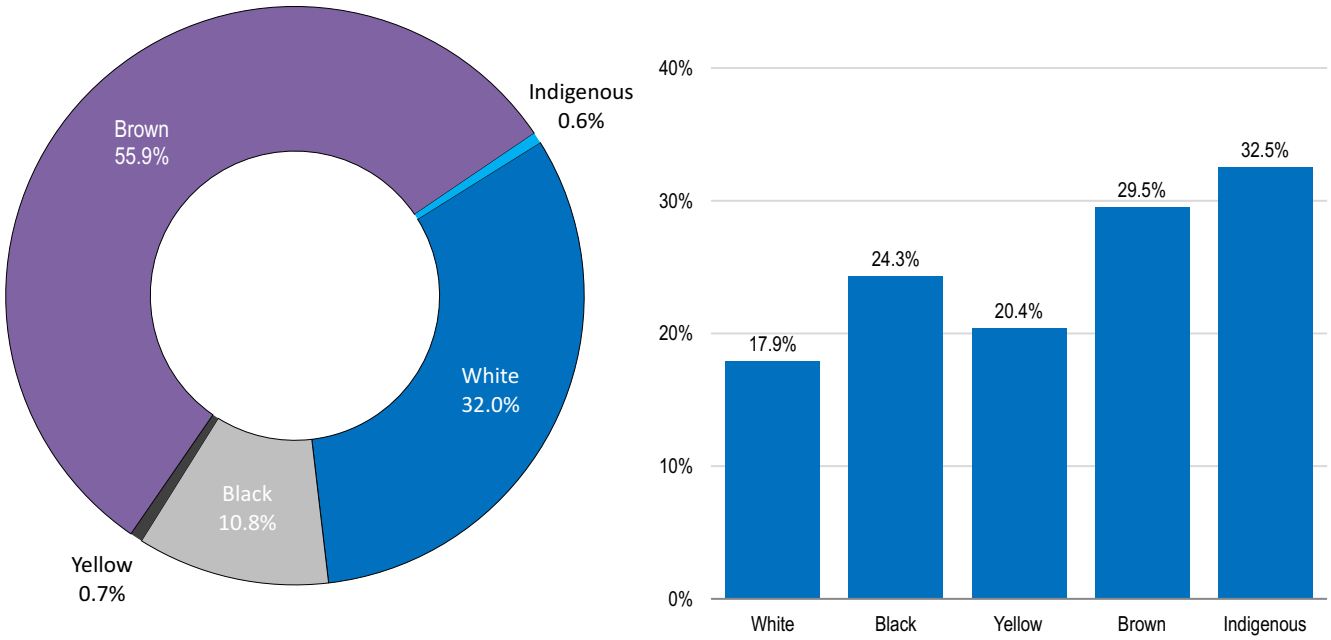


Chart 4.11
Distribution of the population with irregular supply of treated water by self-declared race and relative frequency, Brazil, 2022

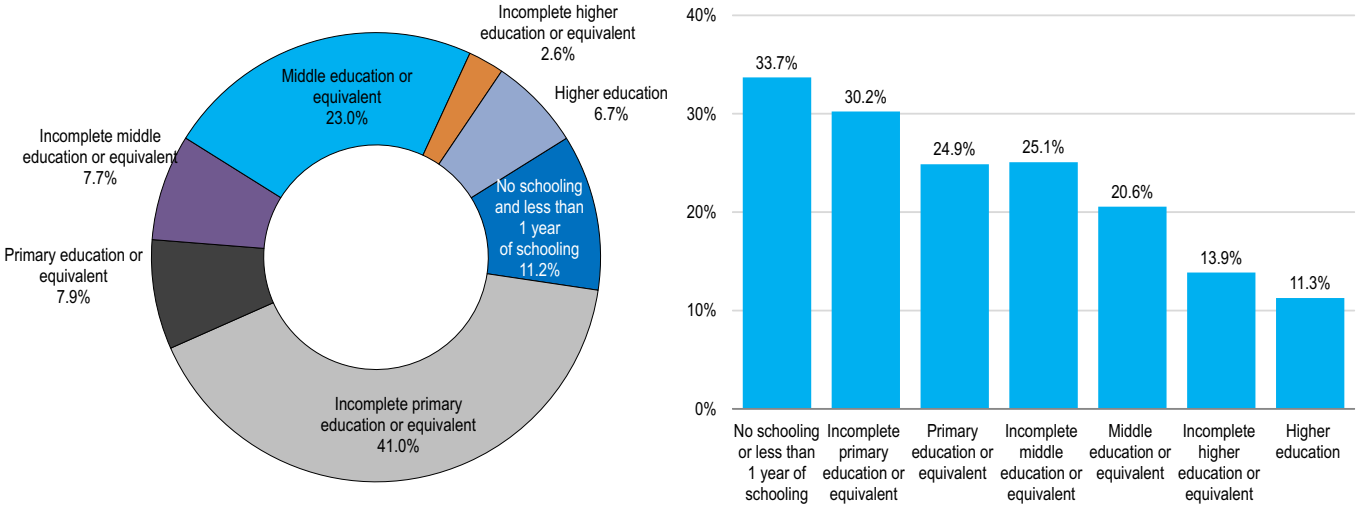


In (%) of the total

In (%) of the total of each self-declared race

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

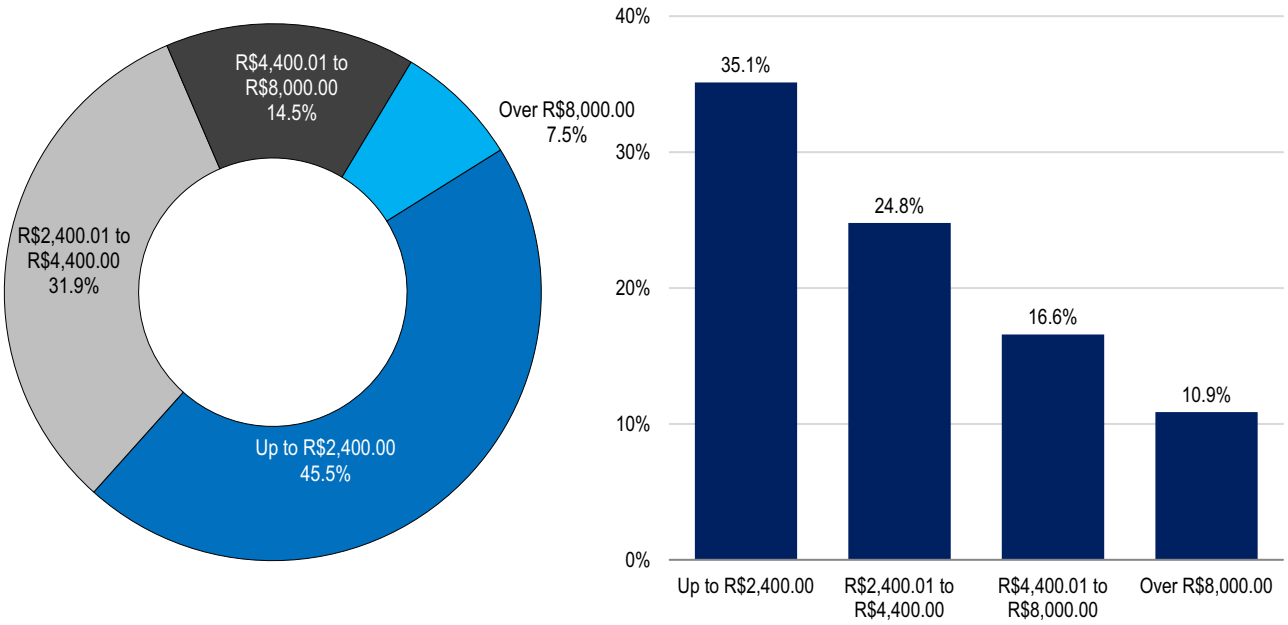
Chart 4.12
Distribution of the population with irregular supply of treated water by level of education and relative frequency, Brazil, 2022



In (%) of the total

In (%) of the total of each level of education

Chart 4.13
Distribution of the population with irregular supply of treated water by household monthly income range and relative frequency, Brazil, 2022



In (%) of the total

In (%) of the total of each household monthly income range

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

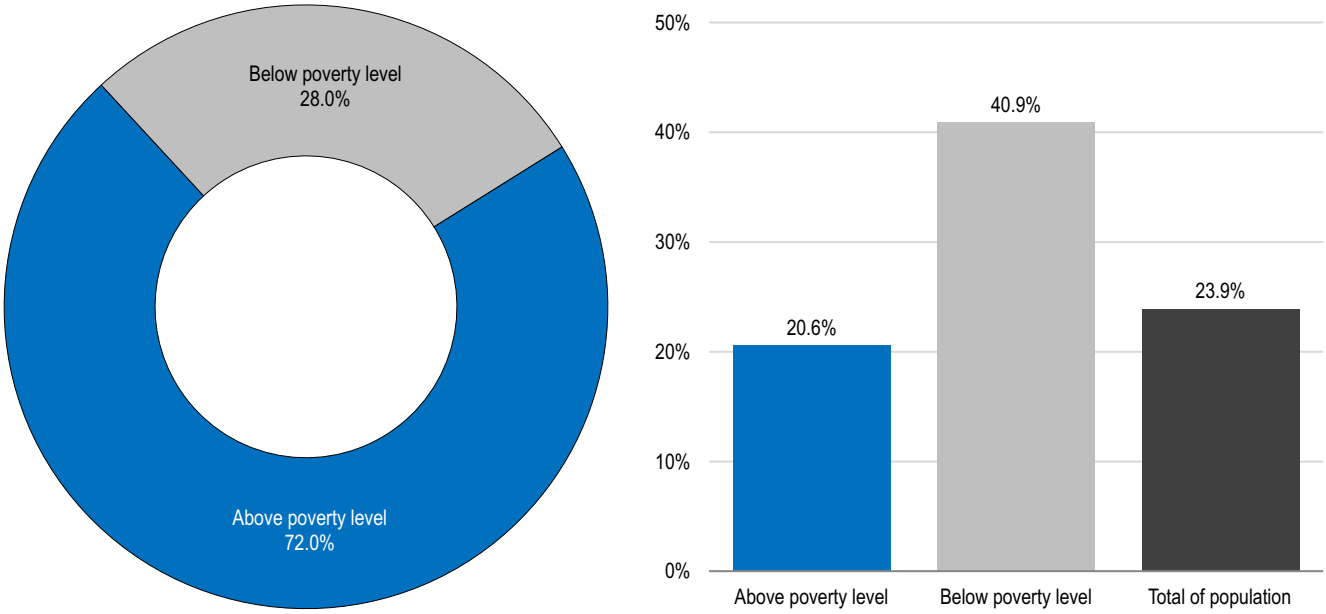
had completed this level, was relatively small, at 9.2% of the total number of people living in homes with an irregular water supply.

The relative frequency of the population with irregular access to treated water varied widely by education level. It can be seen that this frequency was also higher in the less educated groups. Among the uneducated population, 33.7% lived in dwellings where treated water was not supplied daily. This rate gradually fell in the more educated populations, reaching 11.3% for the demographic group with complete higher education.

Once again, this second dimension of deprivation showed a distribution of the population by monthly household income bracket that was heavily concentrated in low-income households. In 2022, 45.5% of the total of 51.197 million people with this deprivation lived in households where the total income was at most R$2,400.00 per month. A further 31.9% of people in deprivation lived in households with a monthly income of between R$2,400.01 and R$4,400.00. These two income classes accounted for 77,4% of the population deprived of access to the general treated water distribution network.

Similarly to what was observed in the case of deprivation of access to treated water, the study identified that 72.0% of the population living in dwellings with an irregular supply of treated water were above the poverty line in 2022. In terms of relative frequency, however, 41 out of every 100 people living below the poverty line had an irregular water supply in 2022.

Chart 4.14
Distribution of the population with irregular supply of treated water by degree of poverty and relative frequency, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Where are the largest affected populations?

		in thousands of people
1	Pernambuco	6,351
2	Bahia	5,610
3	Pará	4,645
4	Rio de Janeiro	4,527
5	Minas Gerais	3,833
6	São Paulo	3,308
7	Maranhão	2,868
8	Ceará	2,369
9	Paraíba	1,820
10	Paraná	1,588
11	Rio Grande do Sul	1,533
12	Rio Grande do Norte	1,478
13	Alagoas	1,429
14	Santa Catarina	1,210
15	Amazonas	1,177
16	Mato Grosso	1,064
17	Rondônia	979
18	Goiás	967
19	Sergipe	845
20	Espírito Santo	836
21	Piauí	778
22	Acre	631
23	Amapá	489
24	Mato Grosso do Sul	313
25	Tocantins	266
26	Distrito Federal	194
27	Roraima	88

Where is this problem most common?

In (%) of population		
70.0%	Acre	1
65.7%	Pernambuco	2
55.3%	Amapá	3
53.7%	Rondônia	4
52.7%	Pará	5
44.8%	Paraíba	6
42.4%	Alagoas	7
41.2%	Rio Grande do Norte	8
40.1%	Maranhão	9
37.4%	Bahia	10
35.8%	Sergipe	11
30.0%	Mato Grosso	12
28.3%	Amazonas	13
25.8%	Rio de Janeiro	14
25.5%	Ceará	15
23.6%	Piauí	16
20.1%	Espírito Santo	17
17.8%	Minas Gerais	18
16.5%	Tocantins	19
16.3%	Santa Catarina	20
14.7%	Roraima	21
13.6%	Paraná	22
13.3%	Rio Grande do Sul	23
13.3%	Goiás	24
11.2%	Mato Grosso do Sul	25
7.0%	São Paulo	26
6.2%	Distrito Federal	27

5

DEPRIVATION OF WATER STORAGE

5.1. Regional distribution

According to PNADC statistics, 10.856 million dwellings had no water storage tanks in 2022, or 14.7% of all homes in the country.

Most of the dwellings deprived of water storage tanks (32.0%) were in the northeastern states of Brazil, totaling 3.473 million homes in 2022. Among states in the Northeast Region, the highest concentration of dwellings with this deprivation was in Bahia, Maranhão, and Ceará. In the entire region, 18.4% of dwellings lacked water storage tanks.

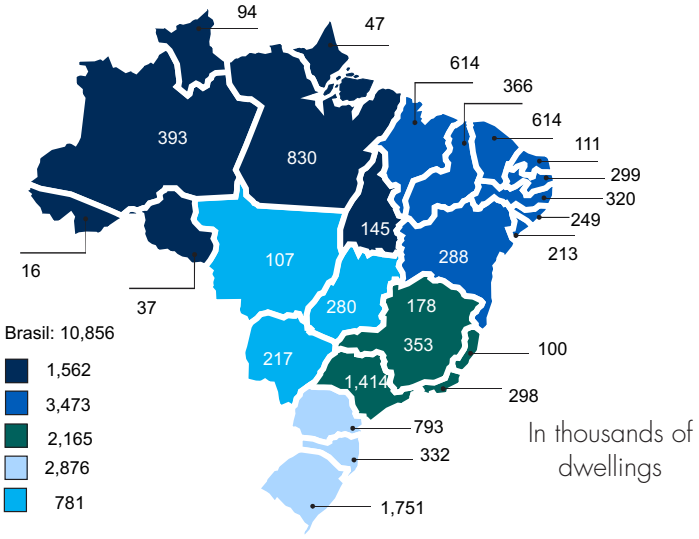
In the South Region, the problem was also severe, with 2.876 million dwellings lacking water storage, or 26.5% of the national total. In this case, however, the share that these dwellings represent of the total number of dwellings was even higher than in the Northeast Region: 26 out of every 100 households lacked a water storage tank in 2022. The North Region had 1.562 million homes lacking water storage, which corresponded to 14.4% of the national total. However, in relative terms, this was the region with the worst rate: around 28 out of every 100 households had no water storage tank.

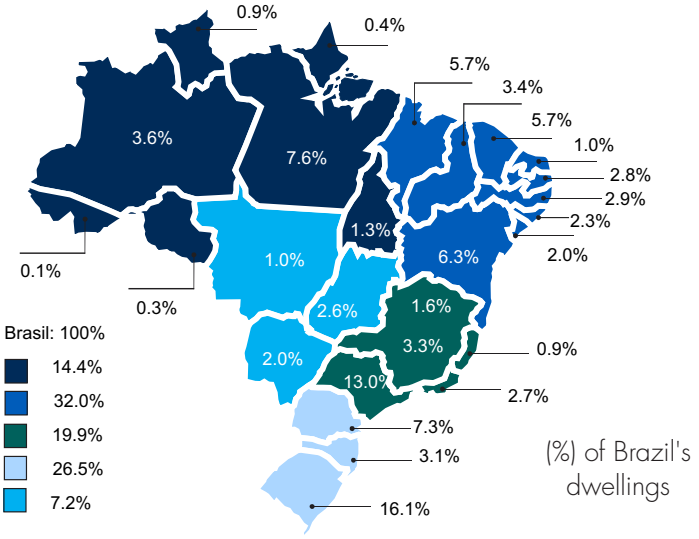
In the Southeast and Center-West regions, this problem was relatively less of a concern. In the Southeast Region, 7 out of every 100 dwellings lacked a water storage tank in 2022 and in the Center-West Region this rate was 13 out of every 100 dwellings.

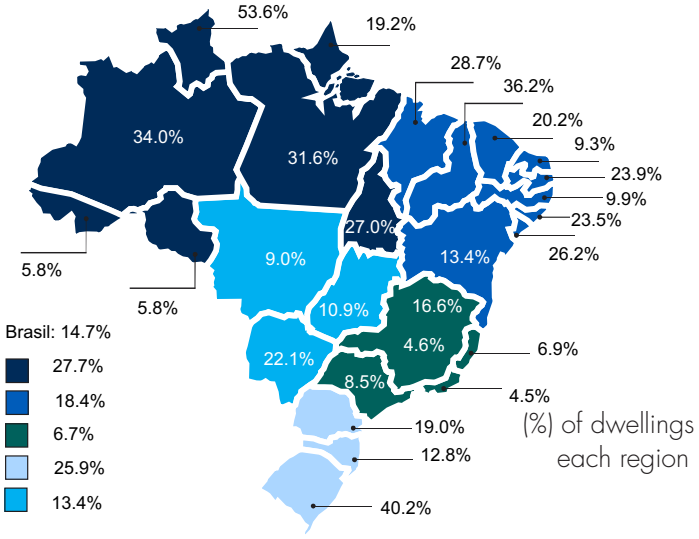
The number of Brazilians living in homes lacking water storage facilities in 2022 was 31.954 million people. This represented 15.0% of the country's population. In terms of population, most of the problem (33.2%) was also located in Brazil's northeastern states, totaling 10.602 million people in 2022. The highest concentration of people deprived of water storage tanks was in the states of Pernambuco, Maranhão, and Ceará. In Piauí, about 36 out of every 100 inhabitants still lacked water storage in their homes that year.

In the South Region, the problem was equally acute, with 7.904 million people living in dwellings lacking water storage tanks, or 24.7% of all such dwellings in Brazil. In this case, however, the share of these people in the total population was even higher than in the Northeast Region, with 26 out of every 100 people living in dwellings without proper water storage in 2022. In the South Region, the biggest problems were in the states of Rio Grande do Sul and Paraná, home to 4.706 million and 2.213 million inhabitants, respectively, without water storage tanks in their homes. In relative terms,

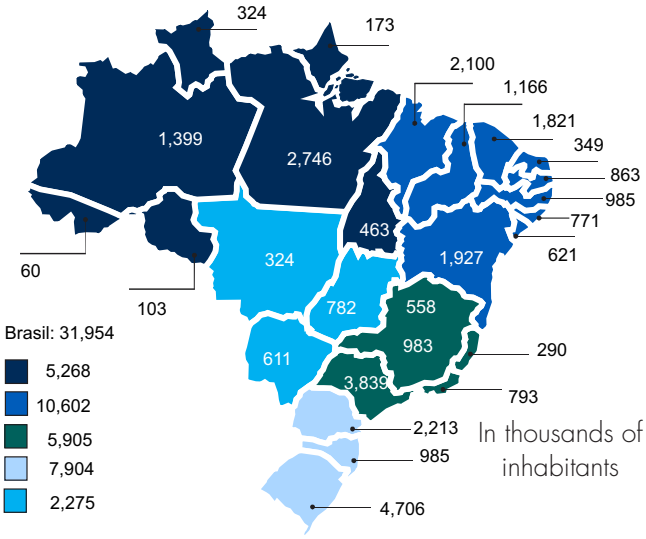
Map. 5.1
Number of dwellings without water storage tanks, 2022

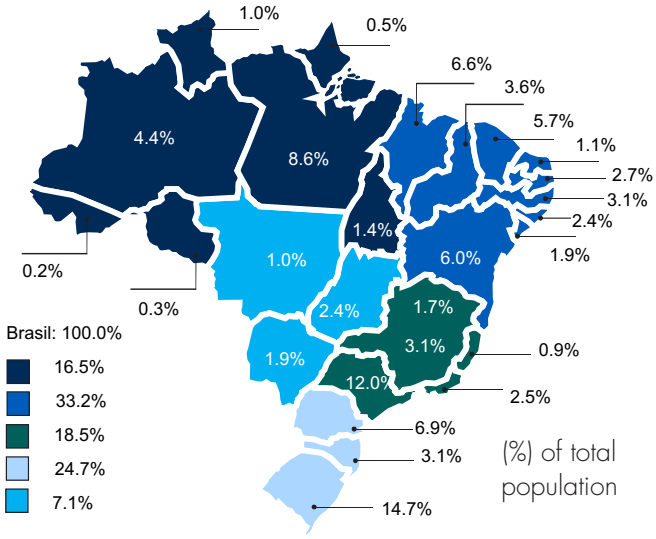


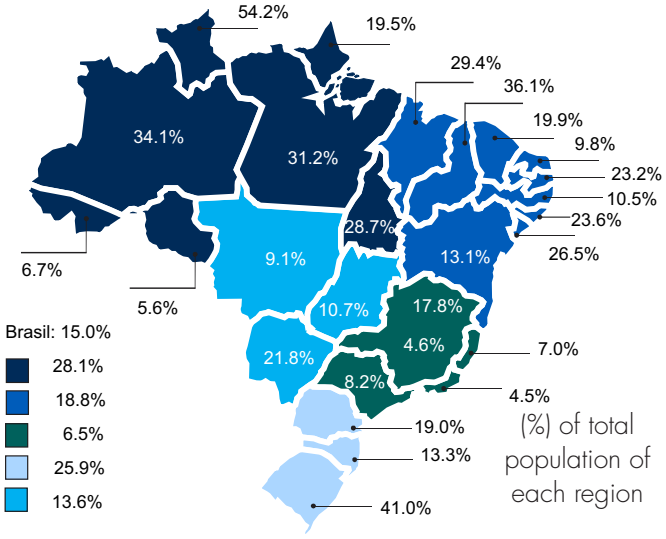




Map. 5.2
Number of population without water storage tanks, 2022







Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Table 5.1
Distribution of dwellings and population by rural and urban areas and portions of dwellings and populations without water storage tanks, Brazil, 2022

	Urban	Rural	Total
		Dwellings	
(%) of deprived homes out of total homes	87.3%	12.7%	100.0%
% of dwellings	14.7%	15.3%	14.7%
		Population	
(%) of deprived population out of total population	49.5%	50.5%	100.0%
(%) of population in each area	15.2%	14.8%	15.0%

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

the lack of a water storage tank affected 41% of the population of Rio Grande do Sul and 20% of the population of Paraná. In the North Region, there was also a sizable portion of the population with this deprivation: 5.268 million people still lived in homes lacking a water storage tank. In relative terms, 28.1% of the population in the north of Brazil did not have this facility in their homes.

Of the total number of Brazilian dwellings lacking proper water storage equipment in 2022, 87.3% were in urban areas and 12.7% in rural areas, suggesting that dwellings in urban areas are more impacted by this deprivation. The relative frequency, however, was very similar between the two regions: 14.7% of urban dwellings did not have a water storage tank, while 15.3% of rural dwellings lacked one. In terms of population, the distribution was also different: 49.5% of the population without a water storage tank lived in the urban areas of Brazilian cities, while 50.5% of the deprived people were in rural areas. As a result, the percentage of the total population in each region that did not have a water storage tank was very similar for all urban and rural residents.

5.2. Changes over time

Similarly to data on access to treated water, compatible historical data for the lack of availability of a water storage tank only go back to 2016. From that year to 2022, the number of deprived dwellings increased from 10.157 million to 10.856 million, indicating that the growth in access to this infrastructure did not keep pace with the growth in the number of dwellings during this period. The growth rate was 1.1% per year, accumulating to a 6.9% increase between 2016 and 2022 in the number of homes without a water storage tank. In relative terms, the percentage of deprived dwellings fell from 15.1% of all dwellings in 2016 to 14.6% of all dwellings in the country in 2022. This amounted to a reduction of 0.5 percentage point.

In population terms, historical data show a distinct downward trend in the lack of availability of domestic water storage. Between 2016 and 2022, the number of people in deprivation remained practically stable, with a variation of just 0.1% over the accumulated period. In relative terms, the percentage of people in deprivation fell from 15.6% of the Brazilian population in 2016 to 14.9% of Brazilians in 2022, a reduction of 0.7 percentage point.

5.3. Profile of deprived homes

Most dwellings lacking water storage facilities were houses. Apartments with this characteristic accounted for only 6.9% of the total 10.856 million dwellings deprived of water storage tanks in 2022,

Chart 5.1
Evolution of housing without water storage tanks, Brazil

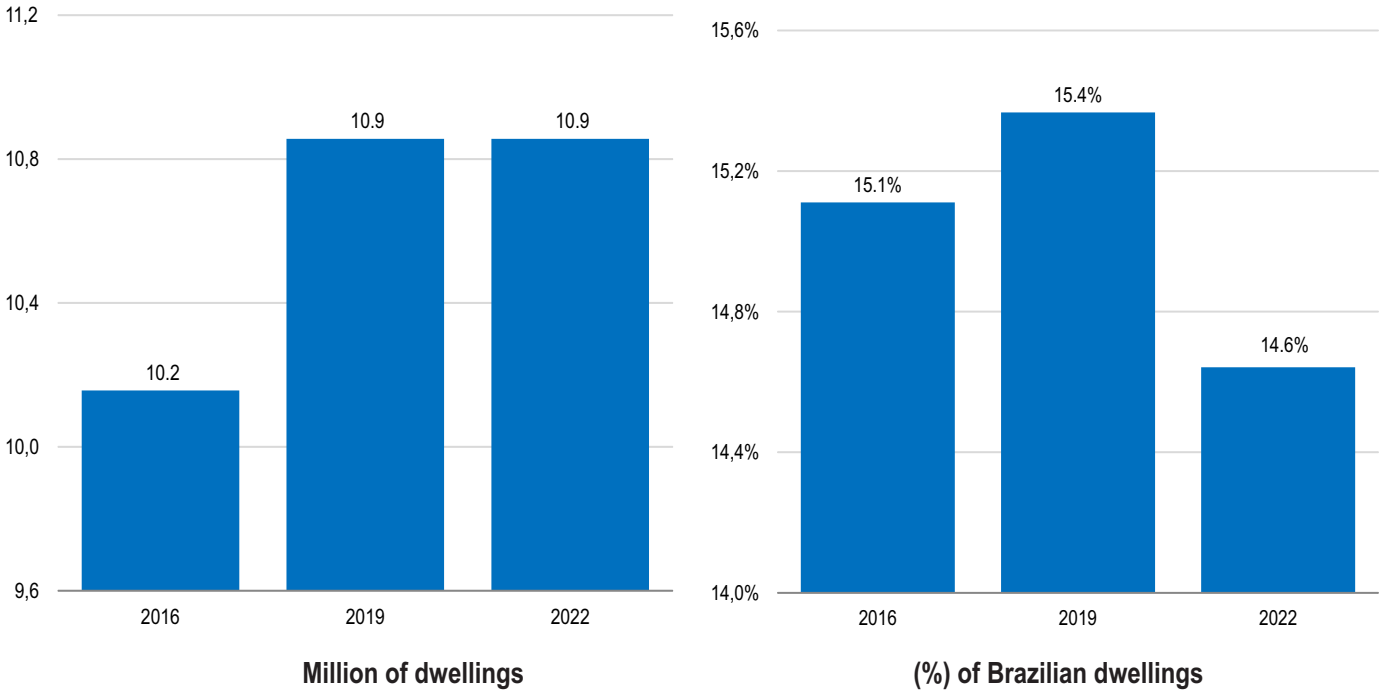
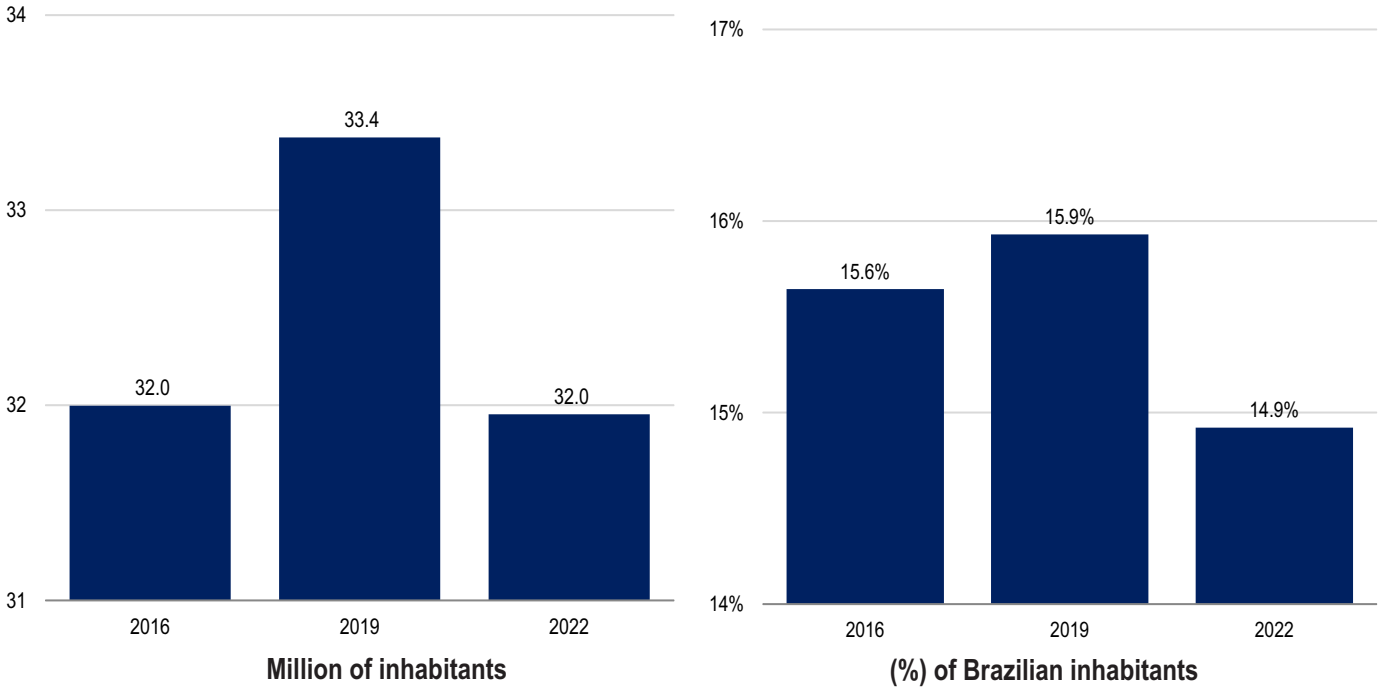


Chart 5.2
Evolution of population without water storage tanks, Brazil



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

while rooming houses represented 7.6%. However, this deprivation was relatively higher in rooming houses: 23 out of every 100 dwellings of this type had no water storage. In the case of houses, 16 out of every 100 were in this condition in 2022.

Graph 5.4 shows that the problem of lack of water storage tanks was more acute among dwellings with inadequate finishing materials. For example, of all the houses made of uncoated rammed earth, 52.2% were deprived of water storage tanks. For dwellings built from scavenged wood, the figure was 42.7%. Only 12.9% of the houses made of coated masonry lacked proper water storage.

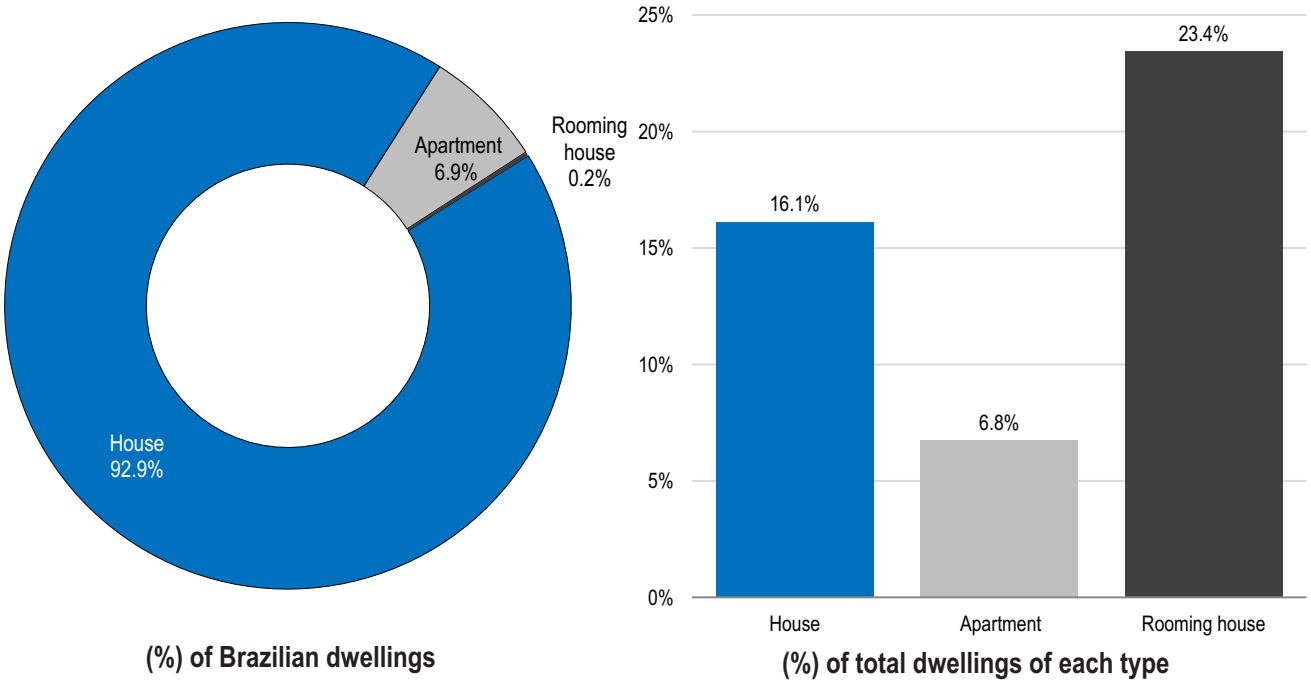
If we look at the roofing material of the dwellings, we see a similar pattern. The proportion of dwellings lacking a water storage tank was relatively higher in dwellings with corrugated metal sheets or other types of roofs, such as scavenged wood and thatch. The lack of water storage was much less frequent in houses with concrete-slab and tiled roofs.

In dwellings with dirt floors, the proportion of those lacking water storage facilities was extremely high (55.7%). In dwellings with wooden or cement floors, the percentage of those deprived of water storage tanks was also relatively high: 14.2% and 30.1%, respectively.

The problem of lack of water storage is related to another major health problem, which is the way waste is collected. This meant that the proportion of dwellings lacking water storage was relatively higher in those where waste was dumped on vacant lots (53.3%). In households where garbage is collected directly by the public cleaning service, the lack of a water storage tank was a problem for 14.2% of all homes.

Most dwellings without water storage were owner-occupied (66.1%) and another high proportion were rented (21.6%). However, a higher relative frequency of dwellings deprived of water storage was identified in dwellings provided by an employer. A total of 20.0% of employer-provided

Chart 5.3
Distribution of dwellings without water storage tanks by type of housing and relative frequency, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 5.4
Relative frequency of dwellings without water storage tanks by wall material, Brazil, 2022

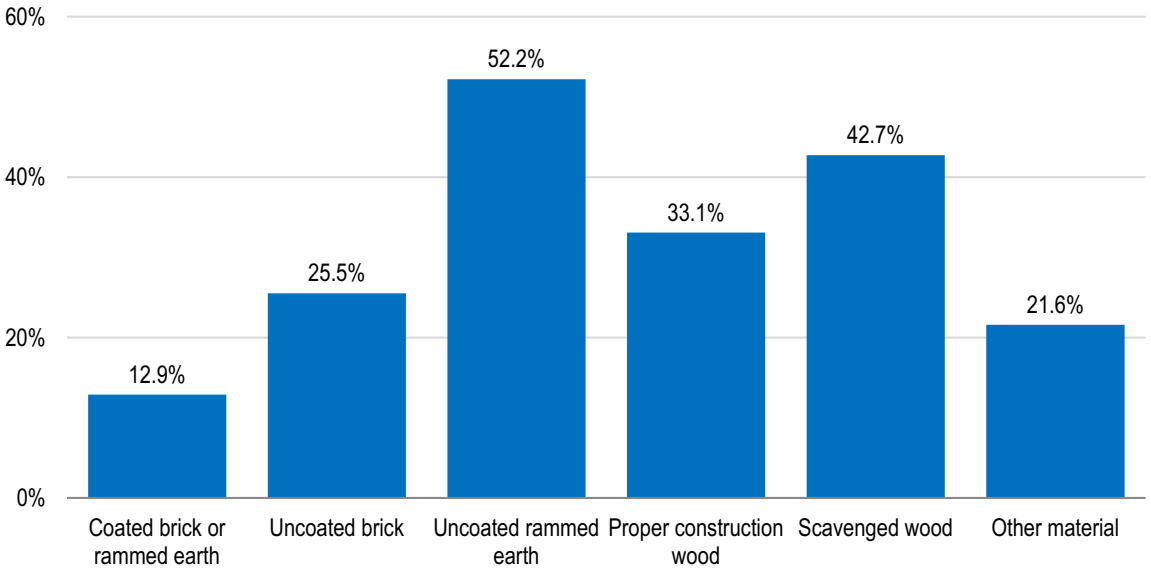
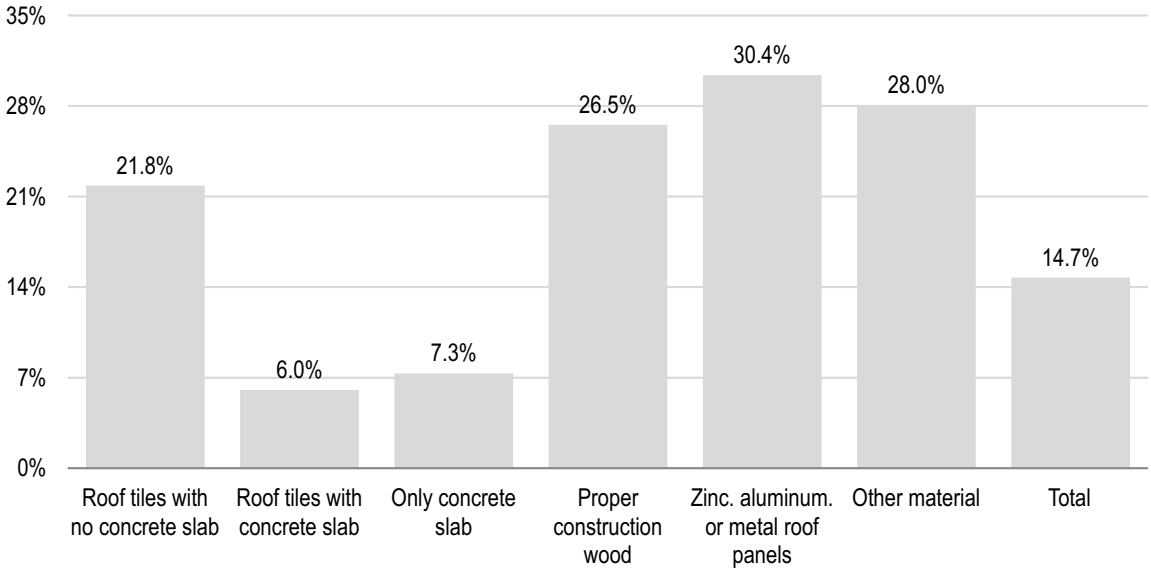


Chart 5.5
Relative frequency of dwellings without water storage tanks by roofing material, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 5.6
Relative frequency of dwellings without water storage tanks by floor material, Brazil, 2022

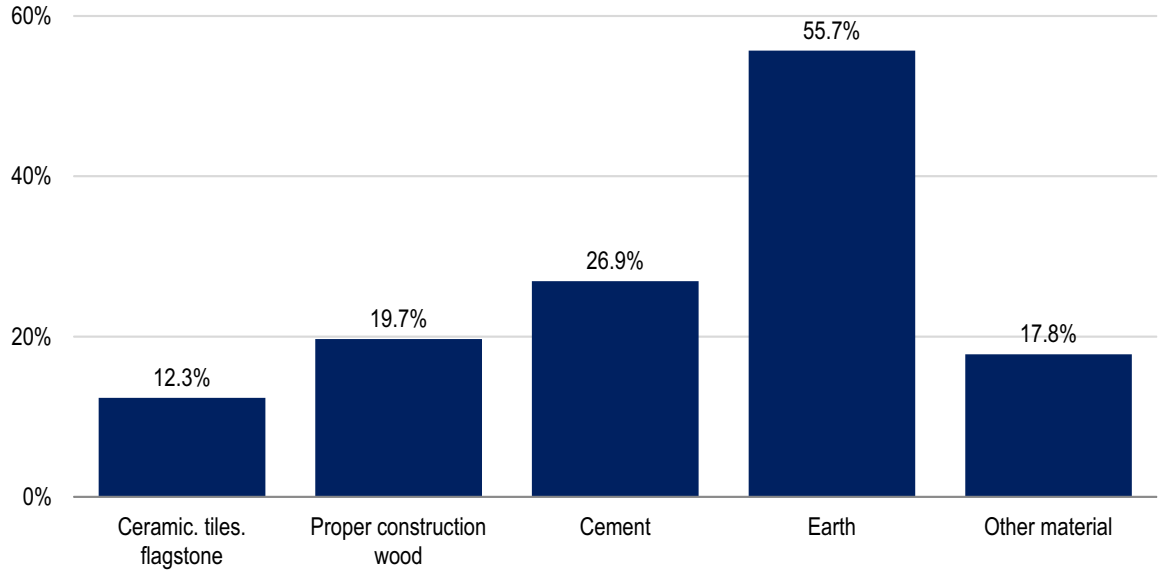
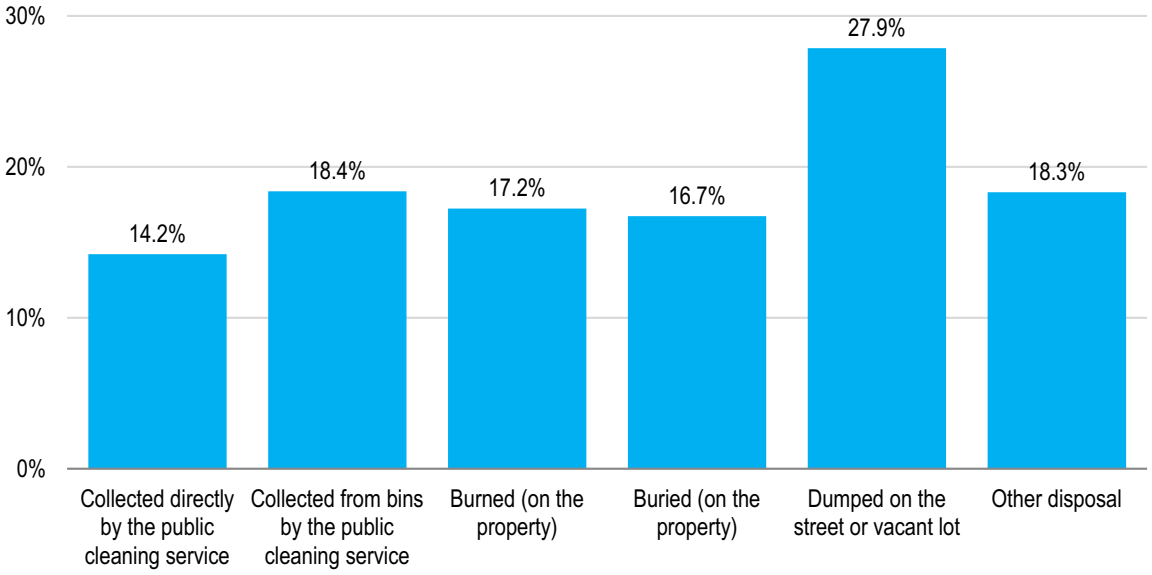


Chart 5.7
Relative frequency of dwellings without water storage tanks by waste destination, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

dwellings lacked a water storage tank, while in the case of owned dwellings, this rate was 14.0% in 2022.

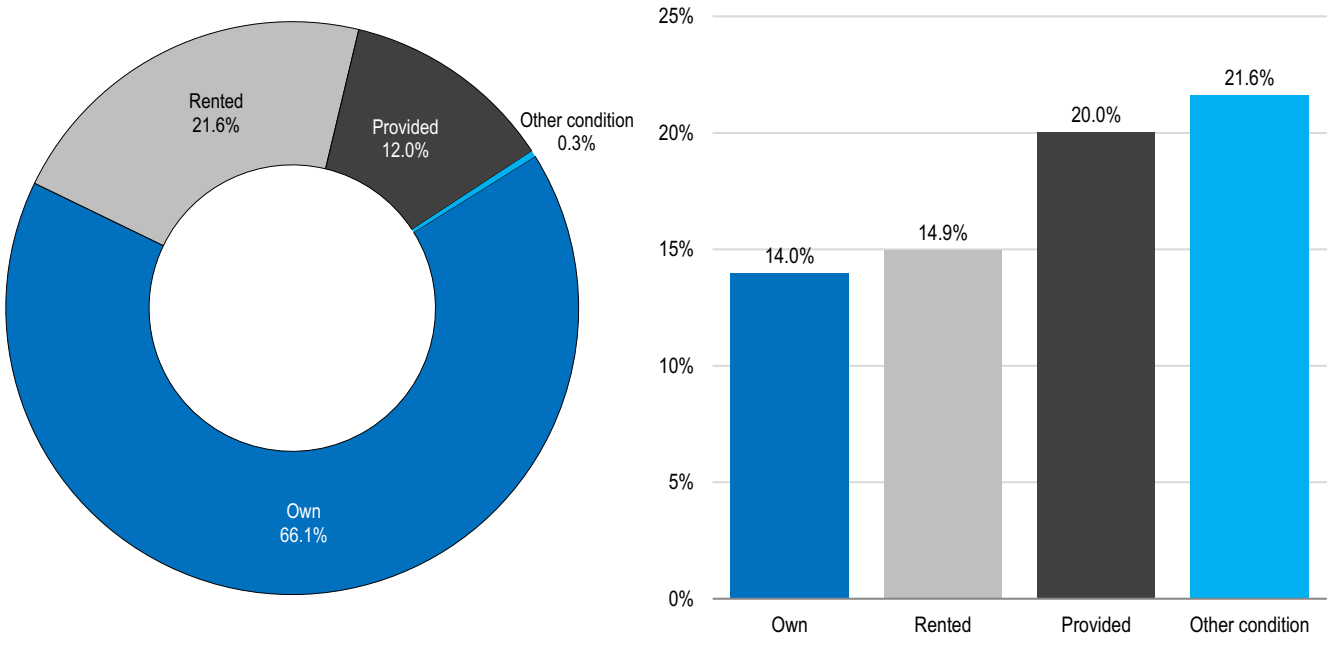
5.4. Deprived population profile

Of the 31.954 million people living in dwellings lacking water storage facilities in 2022, 49.5% were men and 50.5% were women. In relative terms, the frequency of men in this housing condition was 15.2% and the frequency of women was 14.8%, resulting in a weighted average frequency of 15.0% of the total population.

Graph 5.10 shows the relative frequency of the population deprived of water storage across the different age groups in 2022. It should be noted that this frequency was slightly higher in the younger age groups. Among the population aged up to 4 years, 18.5% lived in dwellings with no water storage. This rate drops in older populations, reaching 12.0% for the group of people aged 80 and over. For this reason, 53,4% of the 31.954 million people living in dwellings without water storage tanks in 2022 were under 20 years old, which means that this problem was heavily concentrated among the country's younger population and in families with a larger number of children.

Regarding self-declared race, we see that deprivation of water storage was greater among brown people, accounting for more than half of the Brazilian population in 2022. The self-declared white population accounted for 35.3% and the self-declared black population another 11.6%. In relative terms, however, the highest frequency occurred in the indigenous population, where 23 out of every 100 people had no water storage tanks. The frequency is also higher in the self-declared brown demographic group (17.2%).

Chart 5.8
Distribution of dwellings without water storage tanks by property ownership and relative frequency, Brazil, 2022



In (%) of the total

In (%) of the total for each type of property ownership

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

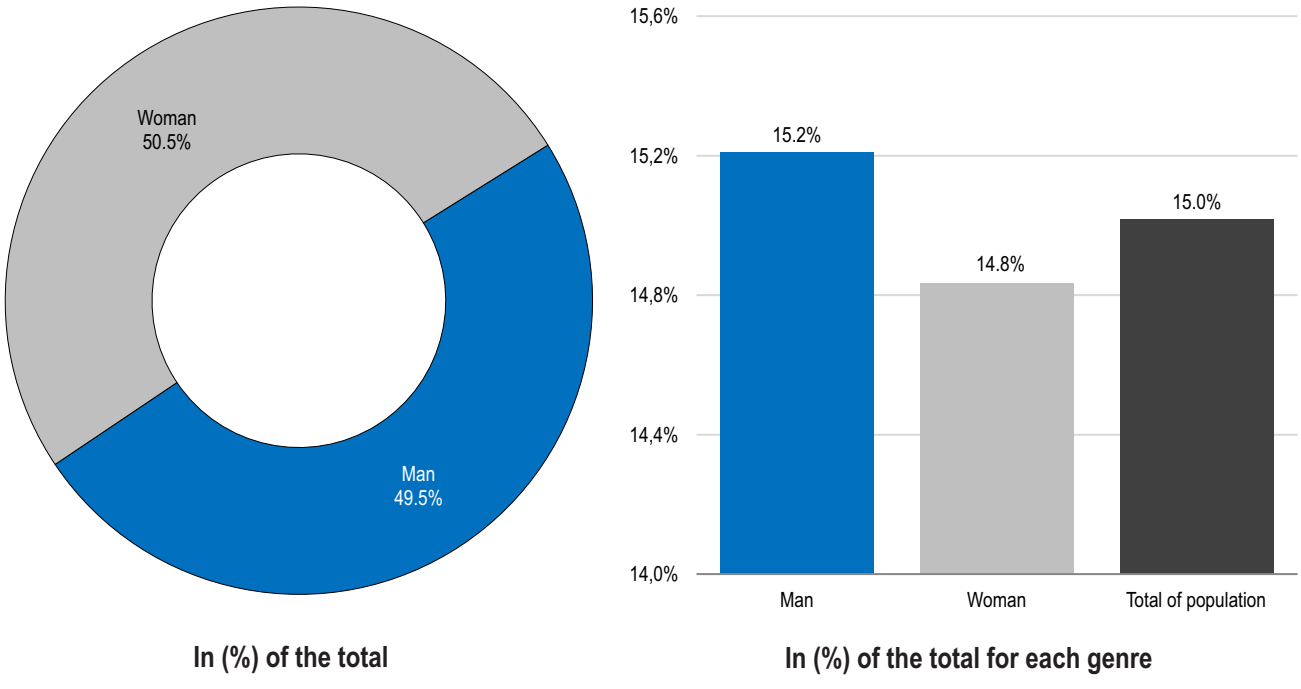
From an educational point of view, much of the population deprived of water storage had no formal education (12.0%) or had not completed elementary school (39.7%). The share of this population that had a college degree was substantially lower, only 6.4% of all Brazilians in 2022.

The relative frequency of the population deprived of water storage facilities varied widely by education level. It should be noted that this frequency was higher in less educated groups. Among the uneducated population, 18.9% lived in dwellings without water storage tanks. This rate gradually fell in the more educated populations, reaching 6.7% for the demographic group with complete higher education.

Graph 5.13 shows the distribution of the population lacking water storage according to monthly household income in 2022. There is a strong concentration of this situation in low-income households: 44.5% of the total of 31.954 million people deprived of a water tank lived in households with a total income up to R$2,400.00 per month. A further 31.9% of people in deprivation lived in households with a monthly income between R$2,400.01 and R$4,400.00. These two income classes accounted for almost 77% of the population deprived of water storage in their homes.

Lastly, the analysis identified that 26.0% of the population living in dwellings lacking water storage tanks were below the poverty line in 2022. However, when we look at the relative frequency, this situation is reversed: 24.2% of people living below the poverty line were deprived of a water storage tank, while only 13.2% of the population above the poverty line were deprived.

Chart 5.9
Distribution of the population without water storage tanks by gender and relative frequency, Brazil, 2022



In (%) of the total

In (%) of the total for each genre

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 5.10
Relative frequency of the population without water storage tanks by age group, Brazil, 2022

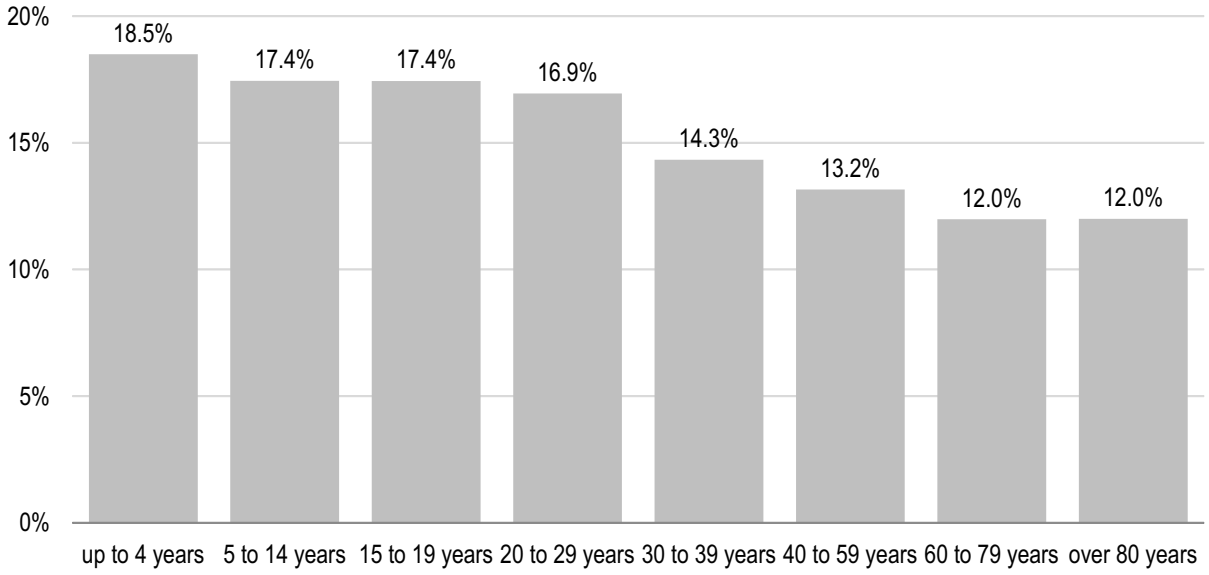
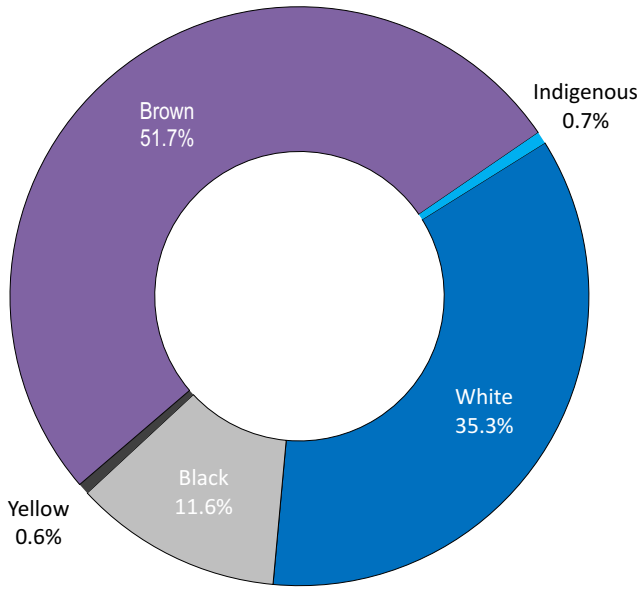
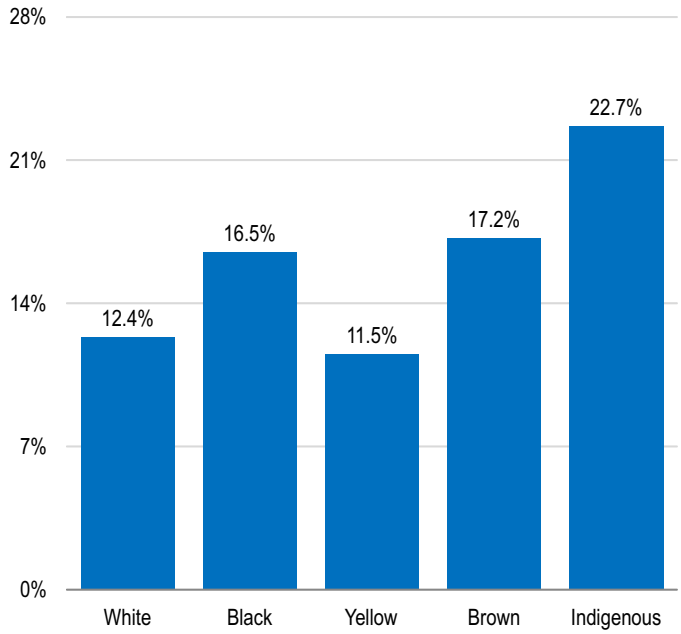


Chart 5.11
Distribution of the population without water storage tanks by self-declared race and relative frequency, Brazil, 2022



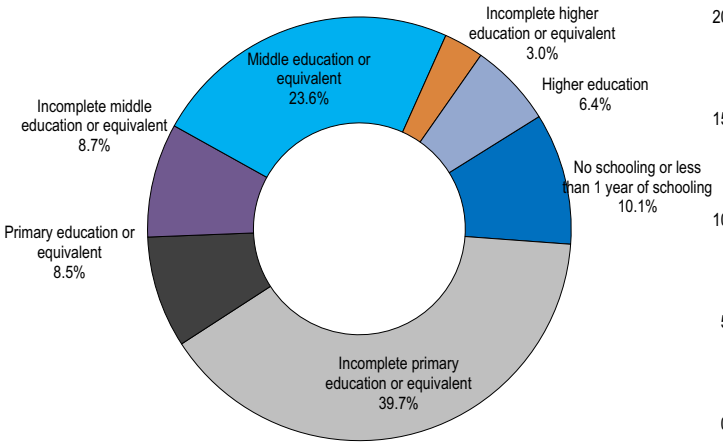
In (%) of the total



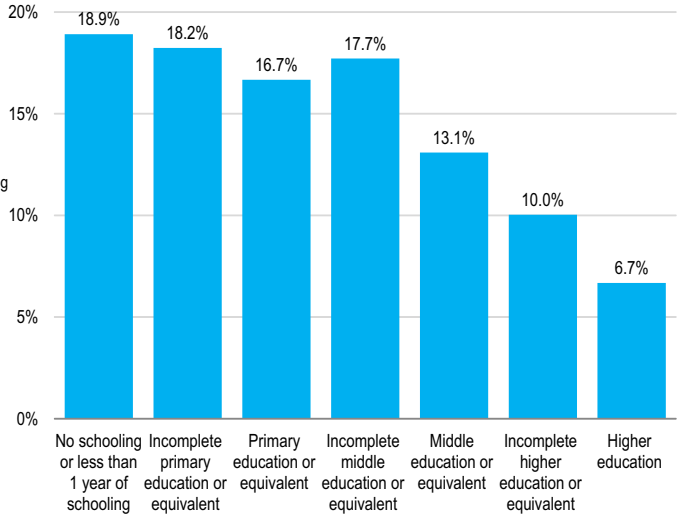
In (%) of the total of each self-declared race

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 5.12
Distribution of the population without water storage tanks by level of education and relative frequency, Brazil, 2022

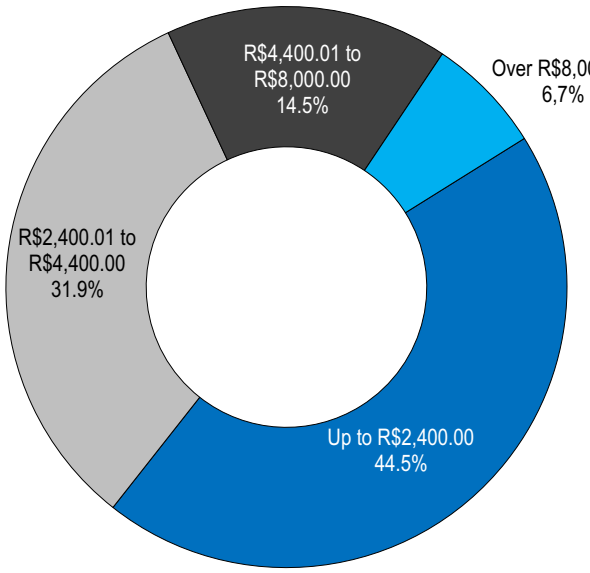


In (%) of the total

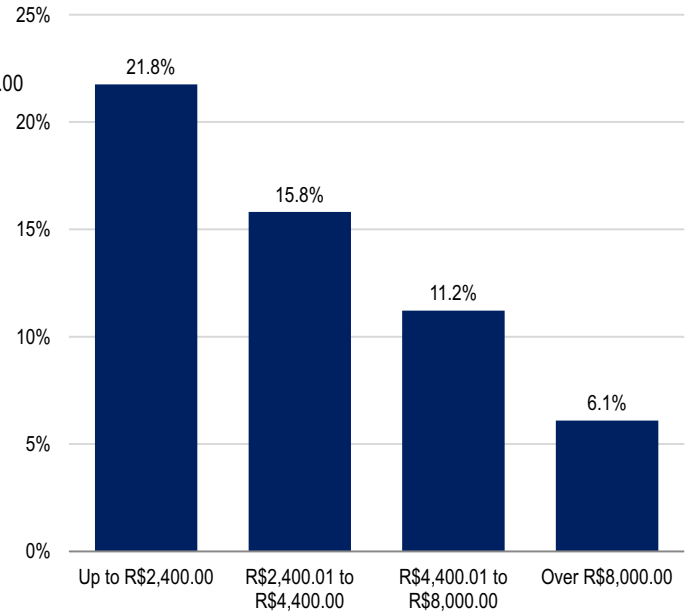


In (%) of the total of each level of education

Chart 5.13
Distribution of the population without water storage tanks by household monthly income range and relative frequency, Brazil, 2022



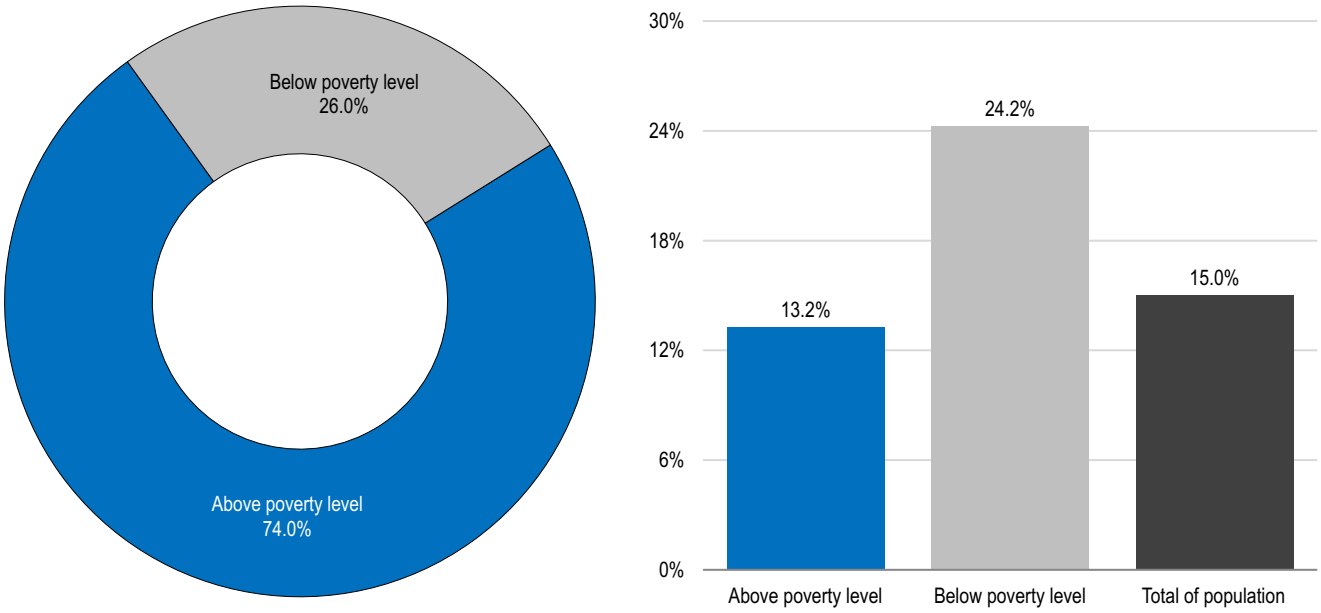
In (%) of the total



In (%) of the total of each household monthly income range

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 5.14
Distribution of the population without water storage tanks by degree of poverty and relative frequency, Brazil, 2022



In (%) of the total

In (%) of the total for each degree of poverty

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Where are the largest affected populations?

		in thousands of people
1	Rio Grande do Sul	4,706
2	São Paulo	3,839
3	Pará	2,746
4	Paraná	2,213
5	Maranhão	2,100
6	Bahia	1,927
7	Ceará	1,821
8	Amazonas	1,399
9	Piauí	1,166
10	Santa Catarina	985
11	Pernambuco	985
12	Minas Gerais	983
13	Paraíba	863
14	Rio de Janeiro	793
15	Goiás	782
16	Alagoas	771
17	Sergipe	621
18	Mato Grosso do Sul	611
19	Distrito Federal	558
20	Tocantins	463
21	Rio Grande do Norte	349
22	Roraima	324
23	Mato Grosso	324
24	Espírito Santo	290
25	Amapá	173
26	Rondônia	103
27	Acre	60

Where is this problem most common?

In (%) of population		
54.2%	Roraima	1
41.0%	Rio Grande do Sul	2
36.1%	Piauí	3
34.1%	Amazonas	4
31.2%	Pará	5
29.4%	Maranhão	6
28.7%	Tocantins	7
26.5%	Sergipe	8
23.6%	Alagoas	9
23.2%	Paraíba	10
21.8%	Mato Grosso do Sul	11
19.9%	Ceará	12
19.5%	Amapá	13
19.0%	Paraná	14
17.8%	Distrito Federal	15
13.3%	Santa Catarina	16
13.1%	Bahia	17
10.7%	Goiás	18
10.5%	Pernambuco	19
9.8%	Rio Grande do Norte	20
9.1%	Mato Grosso	21
8.2%	São Paulo	22
7.0%	Espírito Santo	23
6.7%	Acre	24
5.6%	Rondônia	25
4.6%	Minas Gerais	26
4.5%	Rio de Janeiro	27


6

LACK OF TOILET

6.1. Regional distribution

PNADC statistics show that in 2022 1.332 million dwellings lacked a toilet for the exclusive use of the household. This figure represents 1.8% of all homes in Brazil.

Most of the dwellings deprived of toilets (63.1%) were located in the northeastern states of Brazil, totaling 841,000 homes in 2022. Among states in the Northeast Region, the highest concentration of dwellings with this deprivation was in the states of Maranhão, Bahia, and Piauí. In that region, close to 4 out of every 100 dwellings lacked a toilet for the exclusive use of the household.

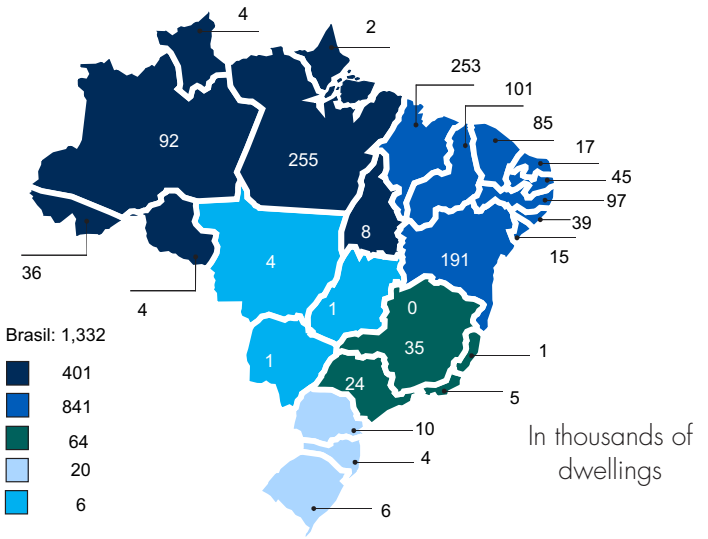
In the North Region, the problem was also severe, with 401,000 dwellings lacking an exclusive toilet, or 30.1% of the national total. In this case, however, the share that these dwellings represent of the total number of dwellings was even higher than in the Northeast Region: 7 out of every 100 households lacked an exclusive toilet in 2022. The biggest problems were in the states of Pará and Amazonas, where there were 255,000 and 92,000 homes, respectively, without an exclusive-use toilet. In relative terms, the lack of an exclusive toilet affected 10 out of every 100 homes in Pará and 8 out of every 100 homes in Amazonas.

In the South, Center-West and Southeast regions, with the exception of the state of Minas Gerais, the lack of toilets was a relatively minor problem. In these states, less than 0.3% of the dwellings lacked a household-exclusive toilet in 2022.

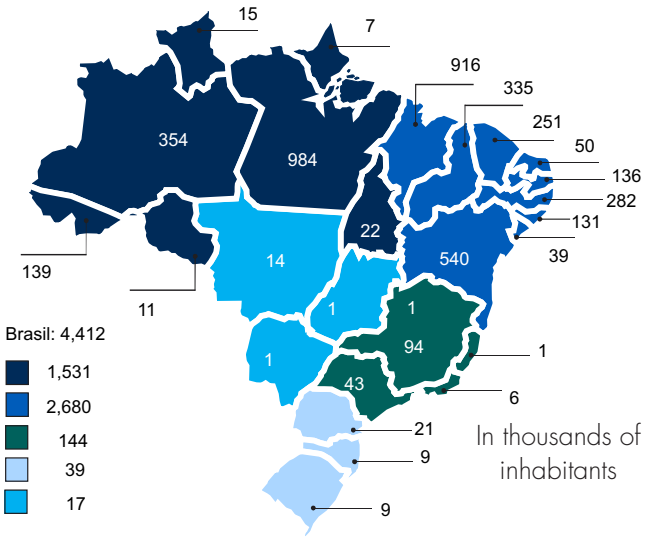
The number of Brazilians living in homes lacking toilet facilities in 2022 was 4.412 million people. This represented 2.1% of the country's population. In terms of population, most of the problem (60.8%) was also located in Brazil's northeastern states, totaling 2.680 million people in 2022. The highest concentration of people deprived of a household-exclusive toilet was in the states of Maranhão, Bahia, and Piauí. In Maranhão, close to 13 out of every 100 dwellings lacked a toilet for the exclusive use of the household.

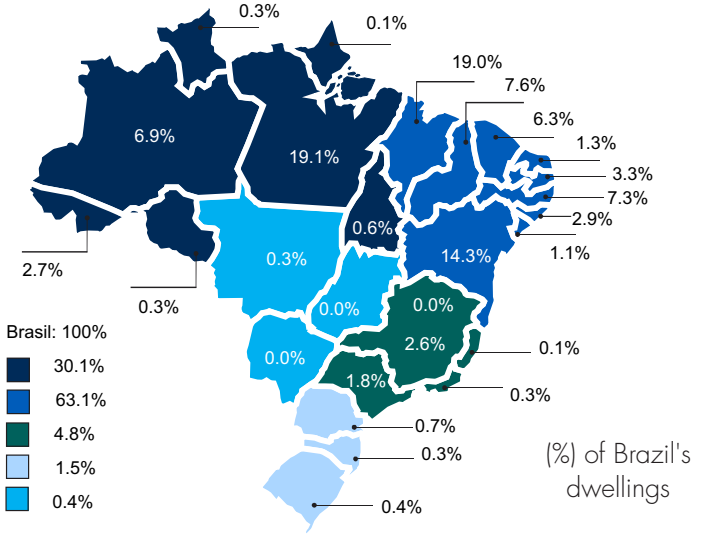
In the North Region, the problem was equally severe, with 1.531 million people living in dwellings without an exclusive toilet. This figure represents 34.7% of the national population. In this case, the share of these people in the total population was even higher than in the Northeast Region, with 8 out of every 100 people living in households without an exclusive toilet in 2022. In the North Region, the biggest problems were again in the states of Pará and Amazonas, where there were 984,000 and 354,000 homes, respectively, without an exclusive-

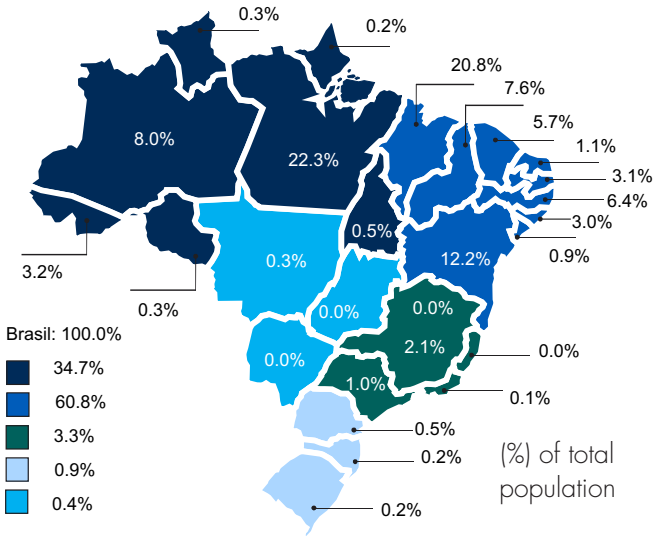
Map. 6.1 Number of dwellings without toilet for the exclusive use of the household, 2022

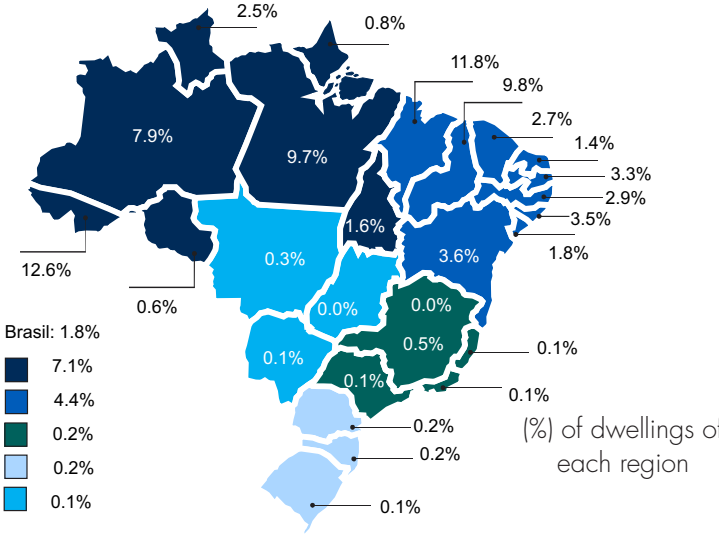


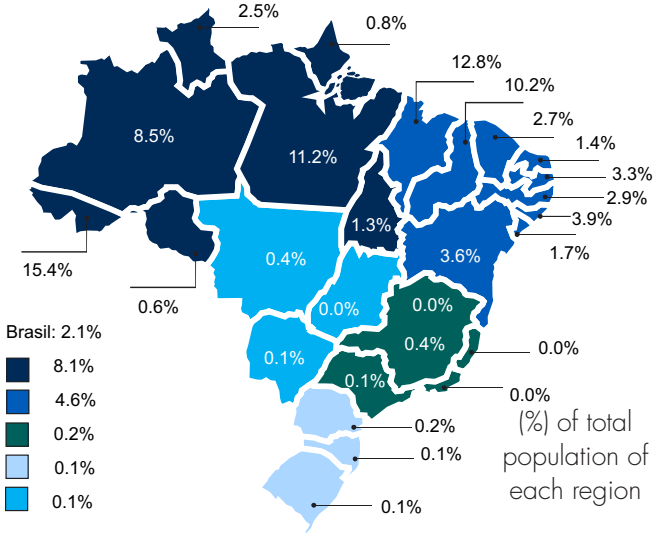
Map. 6.2 Number of population without toilet for the exclusive use of the household, 2022











Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Table 6.1
Distribution of dwellings and population by rural and urban areas and portions of dwellings and populations without toilet for the exclusive use of the household, Brazil, 2022

	Urban	Rural	Total
		Dwellings	
(%) of deprived homes out of total homes	27.4%	72.6%	100.0%
% of dwellings	0.6%	10.3%	1.8%
		Population	
(%) of deprived population out of total population	52.8%	47.2%	100.0%
(%) of population in each area	2.2%	1.9%	2.1%

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

use toilet. In relative terms, the lack of an exclusive toilet affected 10 out of every 100 homes in Pará and 8 out of every 100 homes in Amazonas. The worst relative rate was observed in Acre, a state in which approximately 13 out of every 100 people lived in homes without an exclusive-use toilet.

Of the total number of Brazilian dwellings lacking an exclusive toilet in 2022, 27.4% were in urban areas and 72.6% in rural areas, suggesting that homes in rural areas are more inadequate. This idea is corroborated by the fact that 10 out of every 100 rural dwellings did not have an exclusive toilet. In terms of population, however, the distribution was quite different: 52.8% of the population without an exclusive-use toilet lived in the urban areas of Brazilian cities, while only 47.2% of the people deprived of an exclusive toilet were in rural areas. Accordingly, the percentage of the total population in each region that lacked a household-exclusive toilet ended up being slightly higher among urban dwellers.

6.2. Changes over time

In the case of people who do not have an exclusive toilet in their home, compatible historical data only go back to 2013. From that year to 2022, the number of homes in this type of deprivation fell from 1.918 million to 1.332 million, indicating that 587,000 homes were no longer in a situation of deprivation. The rate of decline was 4.0% per year, accumulating a 30.6% reduction between 2013 and 2022 in the number of people living in homes without an exclusive toilet. In relative terms, the percentage of deprived dwellings fell from 2.9% of all dwellings in 2013 to 1.8% of all dwellings in Brazil in 2022. This amounted to a reduction of 1.1 percentage point.

In population terms, historical data point to a slight downward trend in the number of people without an exclusive toilet. Between 2013 and 2022, the number of people in deprivation fell from 6.532 million to 4.412 million, indicating that more than 2 million people no longer experienced the lack of this basic sanitation service. The rate of decline was 4.3% per year, accumulating a 32.4% reduction between 2013 and 2022 in the number of people living in homes without an exclusive toilet. In relative terms, the percentage of people in deprivation fell from 3.2% of the Brazilian population in 2013 to 2.1% of Brazilians in 2022.

Chart 6.1
Evolution of housing without toilet for the exclusive use of the household, Brazil

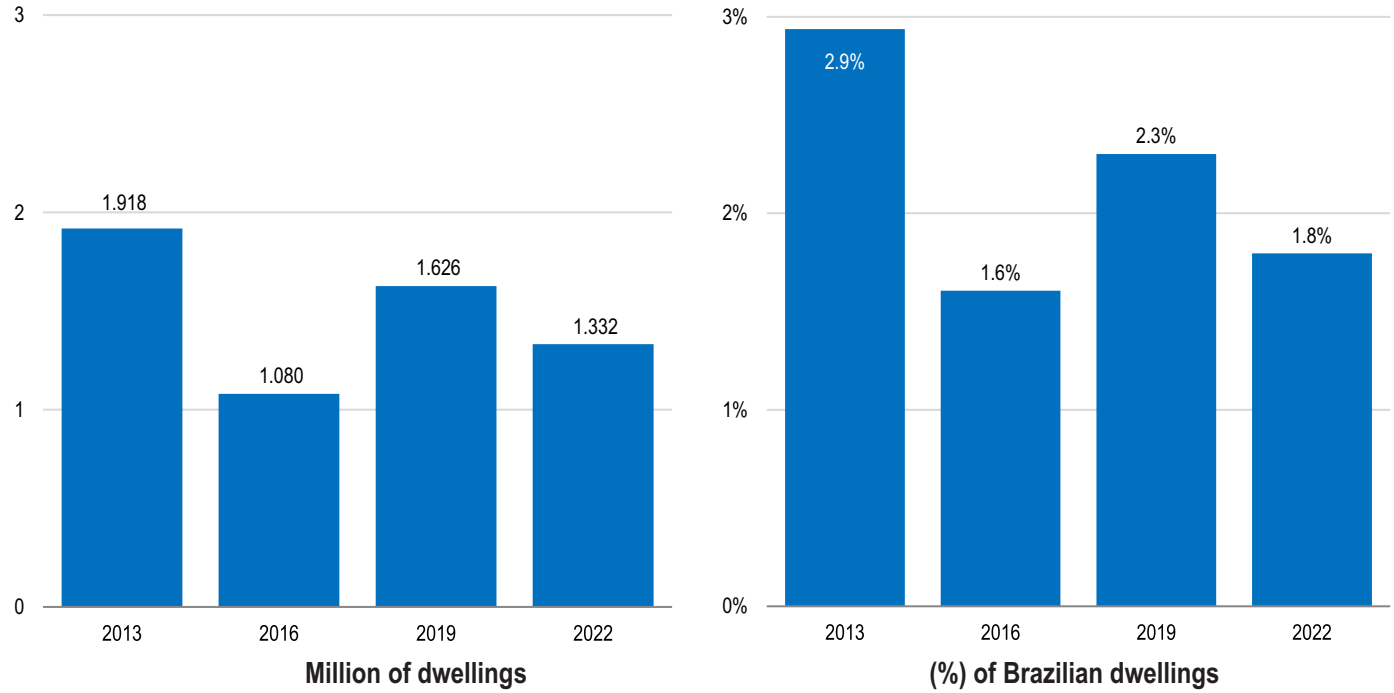
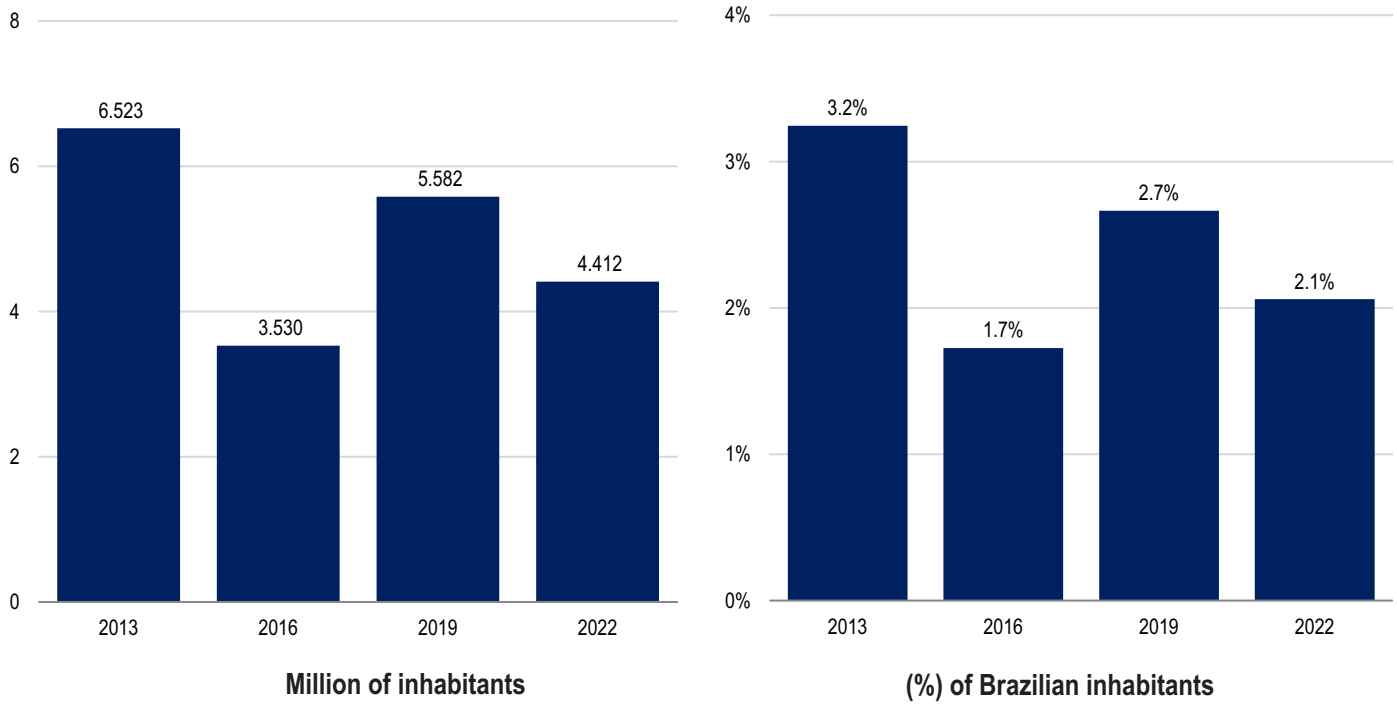


Chart 6.2
Evolution of population without toilet for the exclusive use of the household, Brazil



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

6.3. Profile of deprived homes

The vast majority of dwellings without an exclusive toilet were houses (97.5%). Apartments with this characteristic accounted for only 0.3% of the total 1.3 million dwellings deprived of exclusive toilets in 2022, while rooming houses represented 0.6%. However, this deprivation was relatively higher in rooming houses: 8 out of every 100 dwellings of this type had this type of deprivation. In the case of houses, 2 out of every 100 had this condition in 2022.

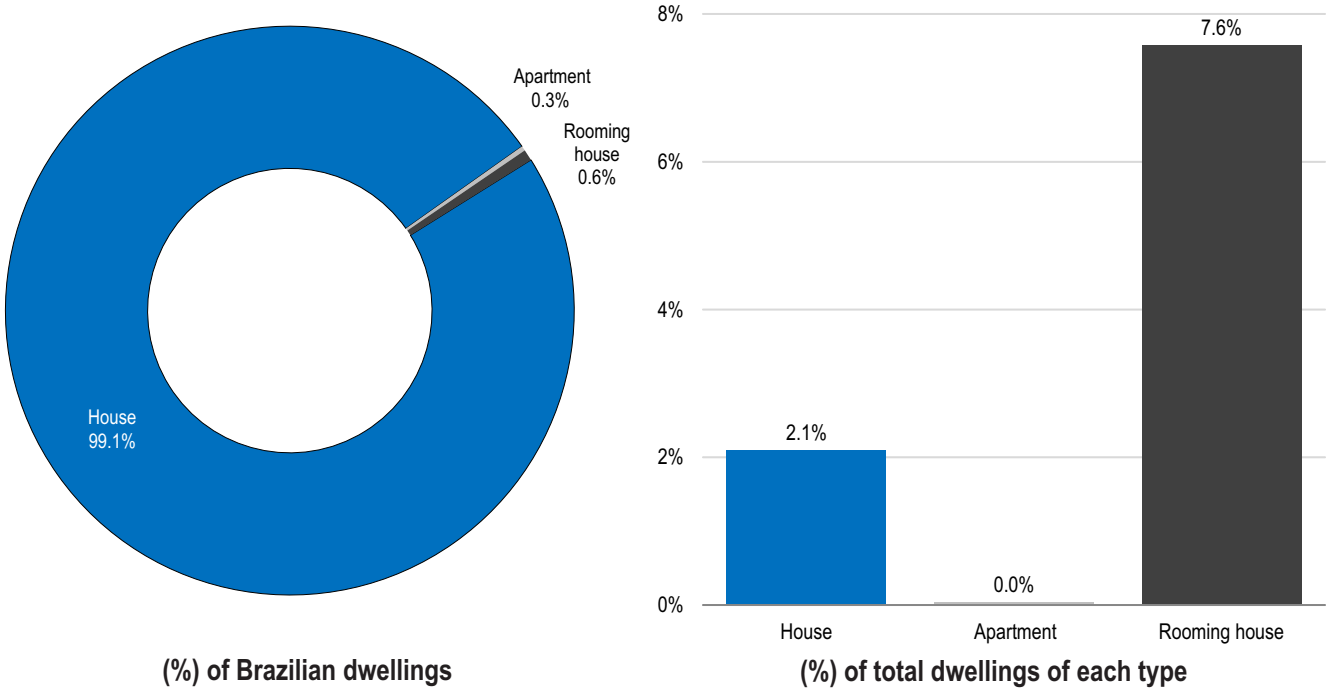
Graph 6.4 shows that the problem of lack of household-exclusive toilets was more acute among dwellings with inadequate finishing materials. For example, of all the houses made of uncoated rammed earth, 52.9% were deprived of a toilet for the exclusive use of the household. The relative rates exceeded 10% in houses made of wood and those made of other materials. Only 0.9% of the houses made of coated masonry had no exclusive toilet.

If we look at the roofing material of the dwellings, we see a similar picture. The proportion of dwellings lacking a household-exclusive toilet was relatively higher in dwellings with corrugated metal sheets or other types of roofs, such as scavenged wood and thatch. The lack of toilets was infrequent in houses with concrete-slab and tiled roofs.

In dwellings with dirt floors, the proportion of dwellings lacking exclusive toilets was extremely high (58.5%). In dwellings with wooden or cement floors, the percentage of homes deprived of household-exclusive toilets was also relatively high: 5.0% and 7.7%, respectively.

The problem of lack of a private toilet is related to another major health problem, which is the way waste is collected. This meant that the proportion of dwellings lacking access to a household-exclusive toilet was relatively higher in households where waste was dumped on waste ground (22.0%), burned on the property (15.8%) or buried on the property (7.7%). In homes where garbage is

Chart 6.3
Distribution of dwellings without toilet for the exclusive use of the household by type of housing and relative frequency, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 6.4
Relative frequency of dwellings without toilet for the exclusive use of the household by wall material, Brazil, 2022

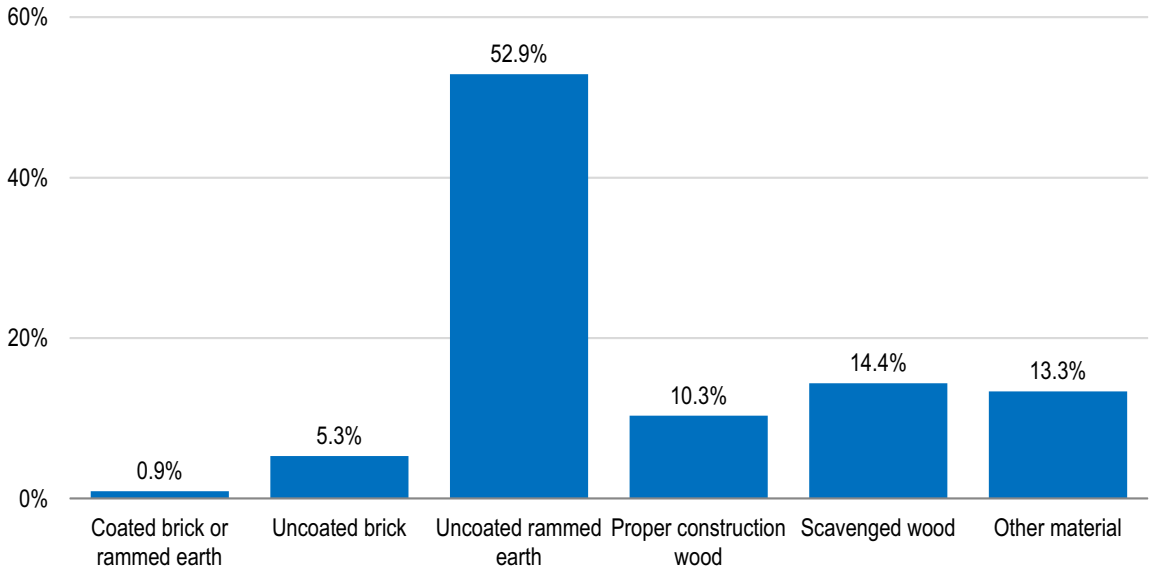
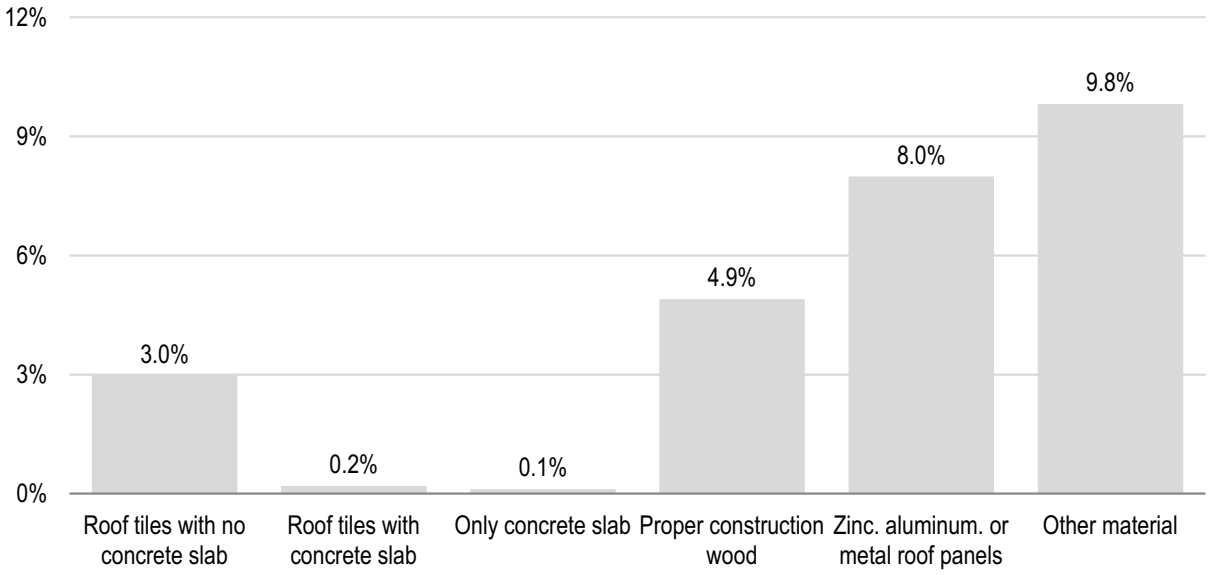


Chart 6.5
Relative frequency of dwellings without toilet for the exclusive use of the household by roofing material, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 6.6
Relative frequency of dwellings without toilet for the exclusive use of the household by floor material, Brazil, 2022

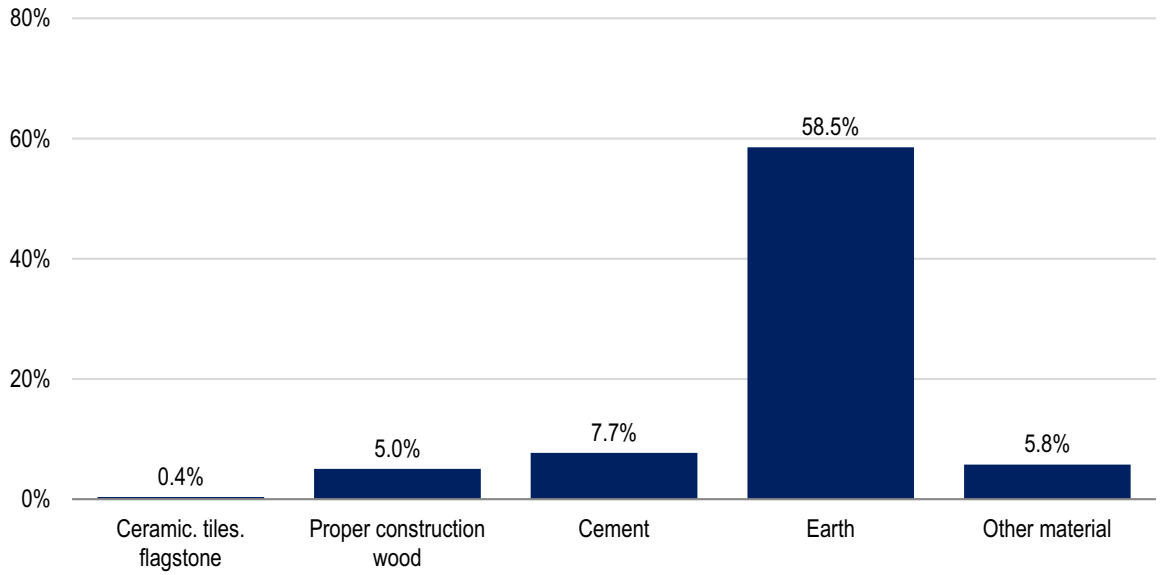
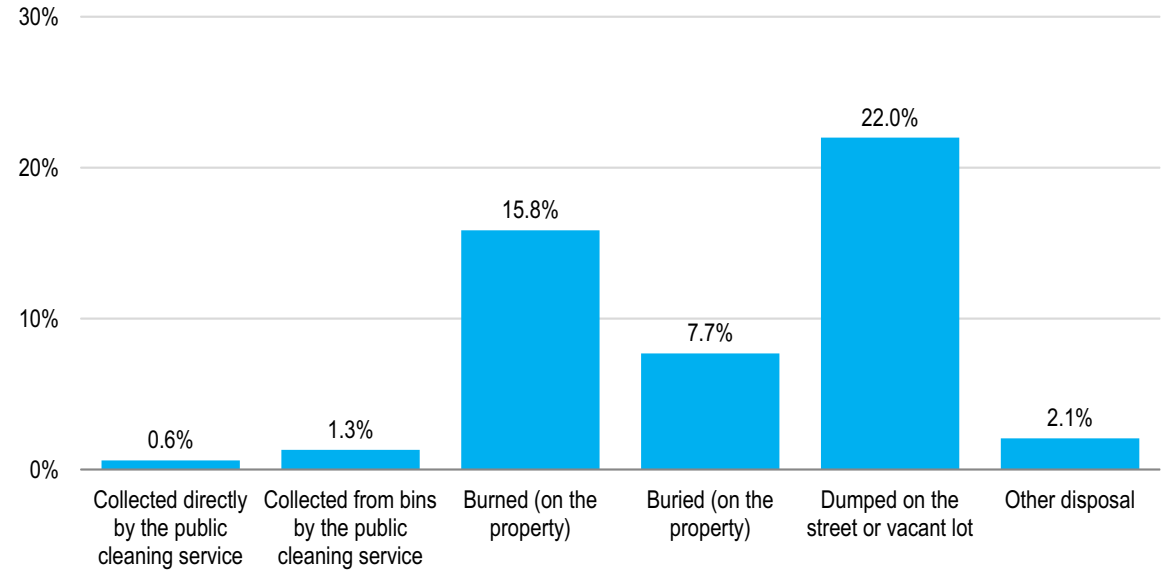


Chart 6.7
Relative frequency of dwellings without toilet for the exclusive use of the household by waste destination, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

collected directly or is collected in bins by the public cleaning service, the problem of lack of a private toilet was less frequent.

The vast majority of dwellings without access to household-exclusive toilets were owner-occupied (83.7%) and another high proportion were rented (13.5%). However, a higher relative frequency of dwellings with toilet deprivation was identified in dwellings provided by an employer. A total of 2.7% of employer-provided dwellings lacked an exclusive toilet, while in the case of owned dwellings, this rate was 2.2% in 2022.

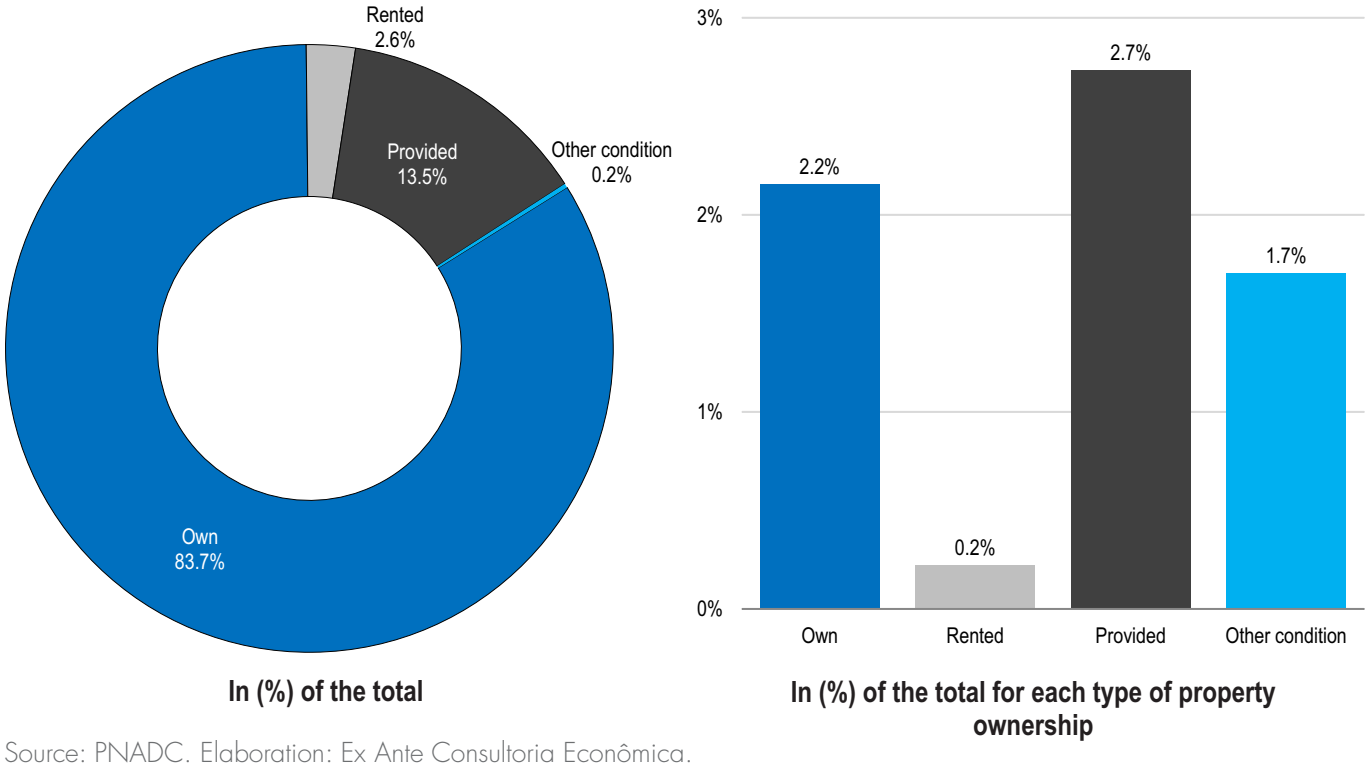
6.4. Deprived population profile

Of the 4.412 million people living in dwellings lacking household-exclusive toilet facilities in 2022, 52.8% were men and 47.2% were women. In relative terms, the frequency of men in this housing condition was 2.2% and the frequency of women was 1.9%, resulting in a weighted average frequency of 2.1% of the total population.

The relative frequency of the population deprived of a toilet for the exclusive use of the household varied widely by education level. We observed that this frequency was slightly higher in the younger age groups. Among the population aged up to 4 years, 3.0% lived in dwellings with no household-exclusive toilets. This rate falls steadily in older populations, reaching 1.1% for the group of people aged 80 and over. As a result, more than 40% of the 4.412 million people living in dwellings without access to a household toilet were under the age of 20, which means that the problem is heavily concentrated among the country's young population and families with larger numbers of children.

Self-declared brown people prevailed in the total population deprived of access to a private toilet, accounting for 73.7% of the total in 2022. The self-declared white population accounted for 13.8% and the self-declared black population another 10.6%. In relative terms, however, the highest frequency occurred in the indigenous population,

Chart 6.8
Distribution of dwellings without toilet for the exclusive use of the household by property ownership and relative frequency, Brazil, 2022



In (%) of the total

In (%) of the total for each type of property ownership

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

where 5 out of every 100 people had no household-exclusive toilets. The frequency is also higher in the brown demographic group (3.4%).

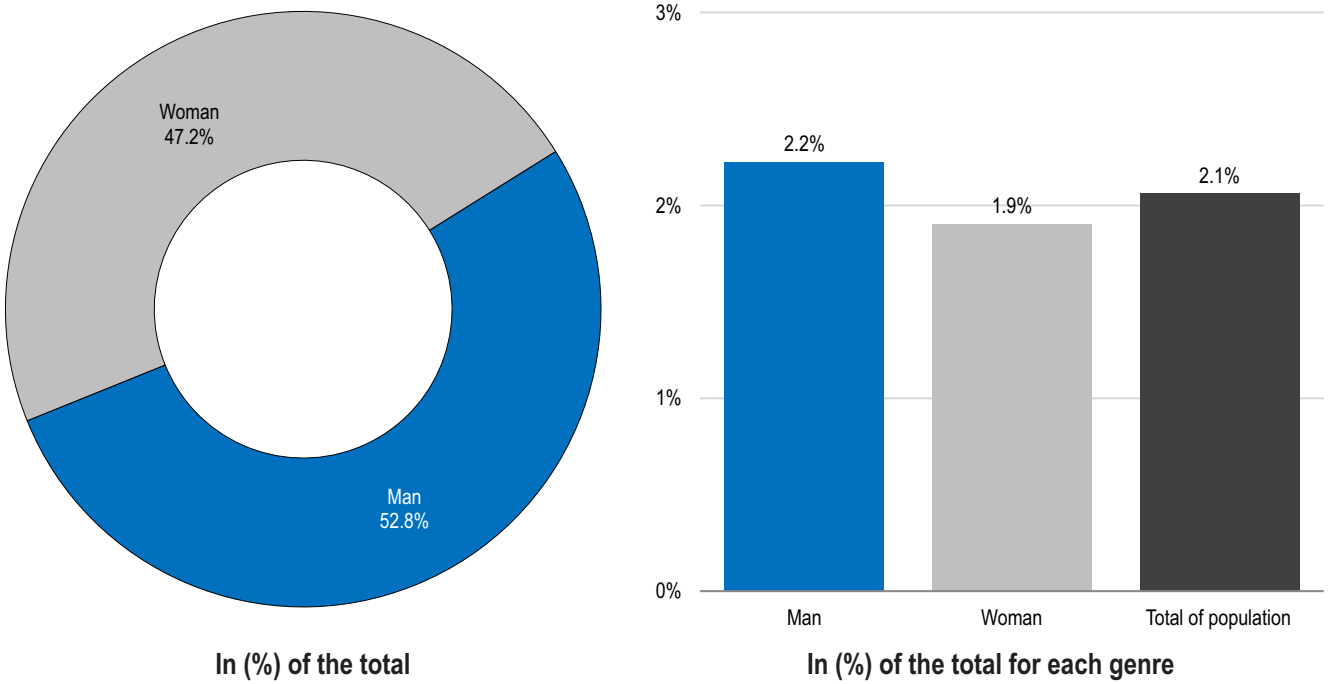
From an educational point of view, the vast majority of the population deprived of toilets exclusive to the household had no formal education (18.1%) or had not completed elementary school (54.5%). The proportion of the population who had reached higher education, whether or not they had completed this cycle, was relatively small, at 1.2% of the total number of people who were deprived of access to private toilets.

The relative frequency of the population deprived of household-exclusive toilet facilities varied widely by education level. We observe that this frequency was higher in the less educated groups. Among the uneducated population, 4.5% lived in dwellings without private toilets. This rate steadily fell in the more educated populations, reaching 0.1% for the demographic group who graduated from college.

The distribution of the population lacking a household-exclusive toilet by monthly household income bracket shows a strong concentration of low-income households. In 2022, 76.2% of the total of 4.412 million people with this deprivation lived in households where the total income was at most R$2,400.00 per month. A further 19.5% of people in deprivation lived in households with a monthly income of between R$2,400.01 and R$4,400.00. These two income classes accounted for almost 96% of the population deprived of private toilets in their homes.

Lastly, the analysis identified that 60.7% of the population living in dwellings lacking household-exclusive toilets were below the poverty line in 2022. In terms of relative frequency, however, 8 out of every 100 people living below the poverty line lacked toilets in 2022.

Chart 6.9
Distribution of the population without toilet for the exclusive use of the household by gender and relative frequency, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 6.10
Relative frequency of the population without toilet for the exclusive use of the household by age group, Brazil, 2022

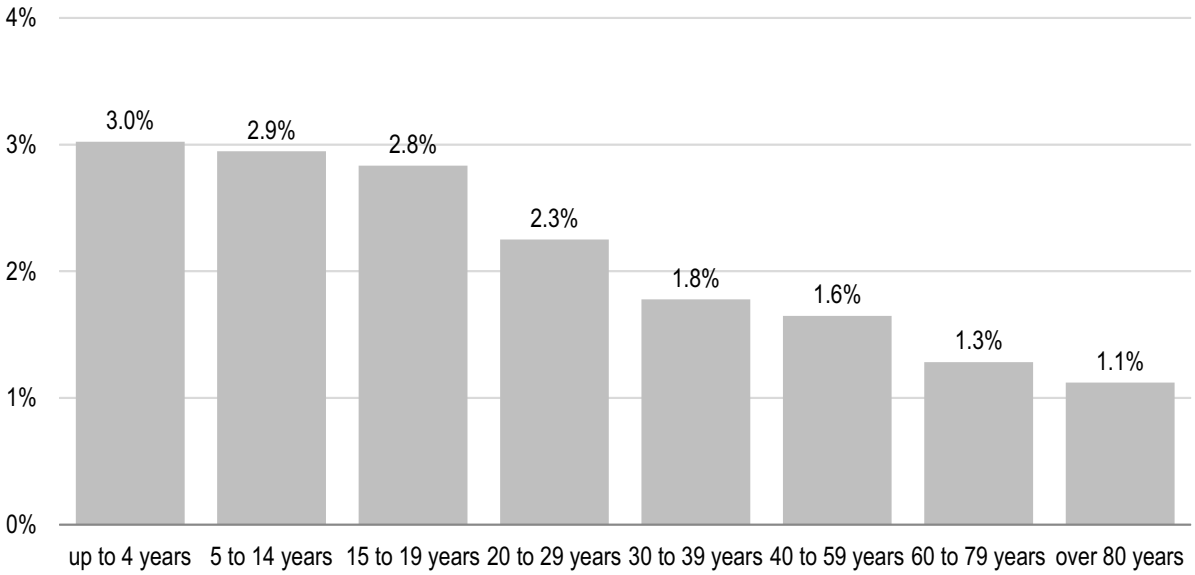
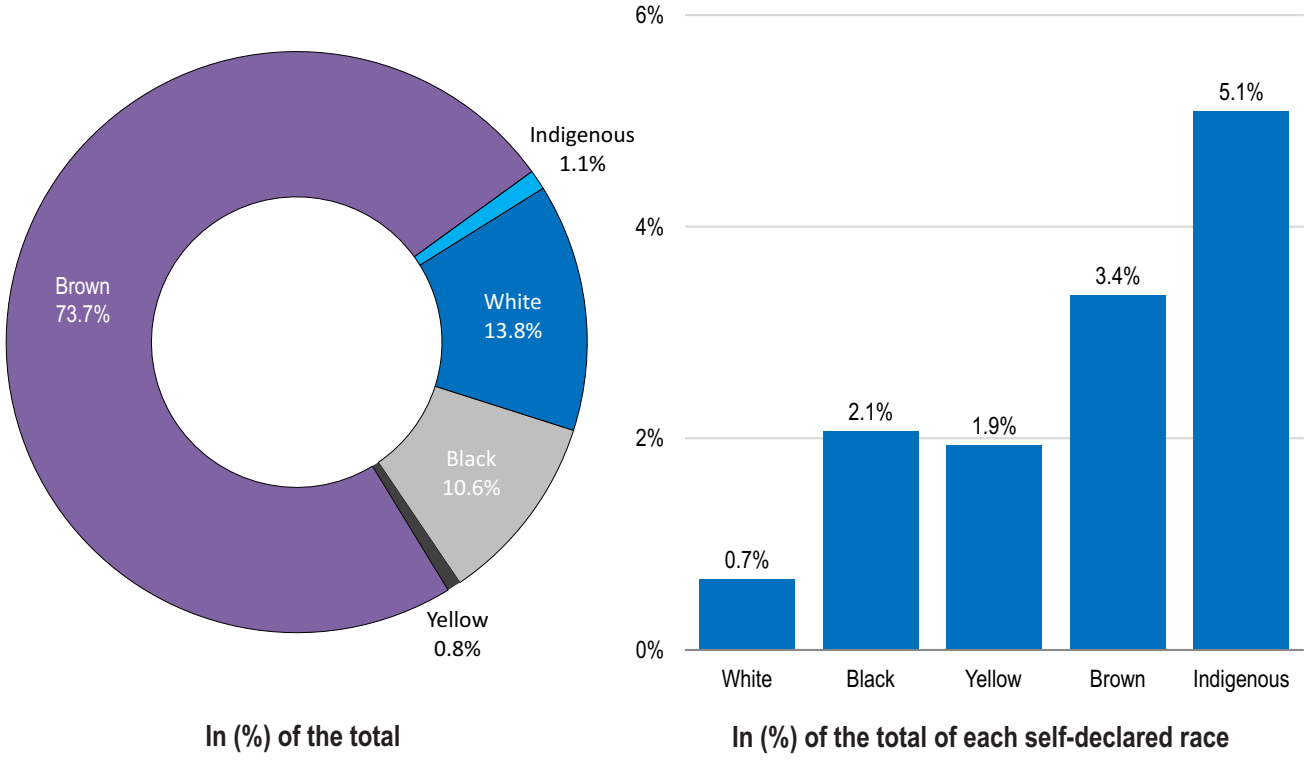
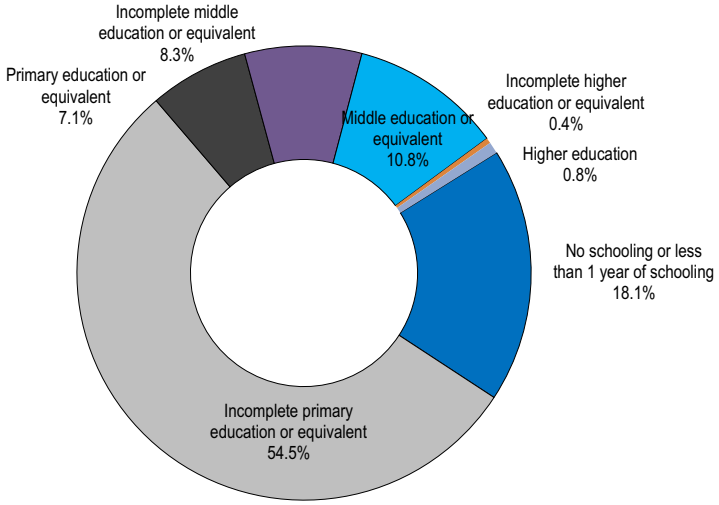


Chart 6.11
Distribution of the population without toilet for the exclusive use of the household by self-declared race and relative frequency, Brazil, 2022

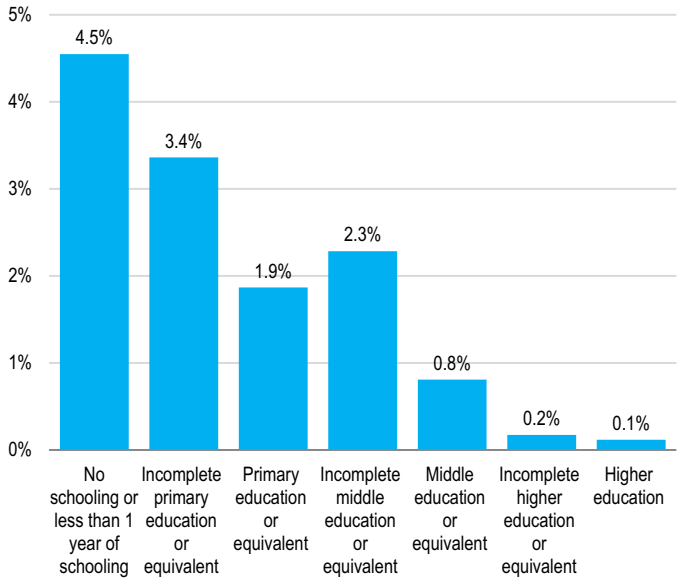


Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 6.12
Distribution of the population without toilet for the exclusive use of the household by level of education and relative frequency, Brazil, 2022

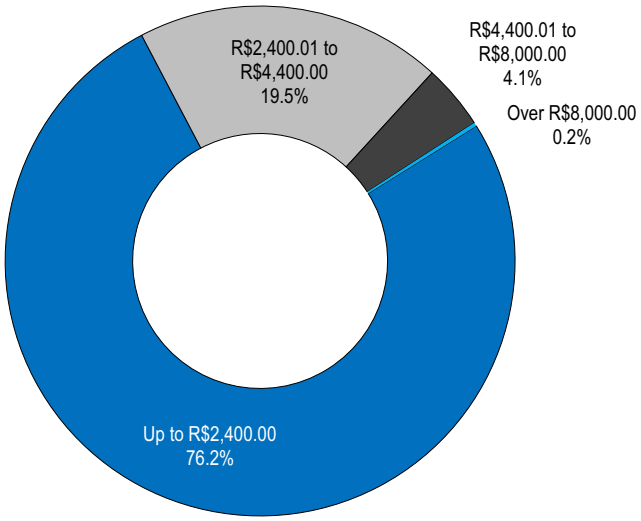


In (%) of the total

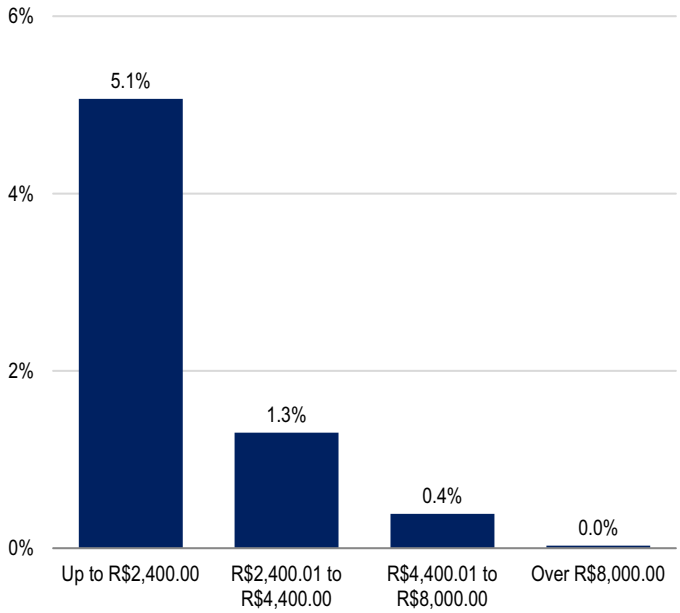


In (%) of the total of each level of education

Chart 6.13
Distribution of the population without toilet for the exclusive use of the household by household monthly income range and relative frequency, Brazil, 2022



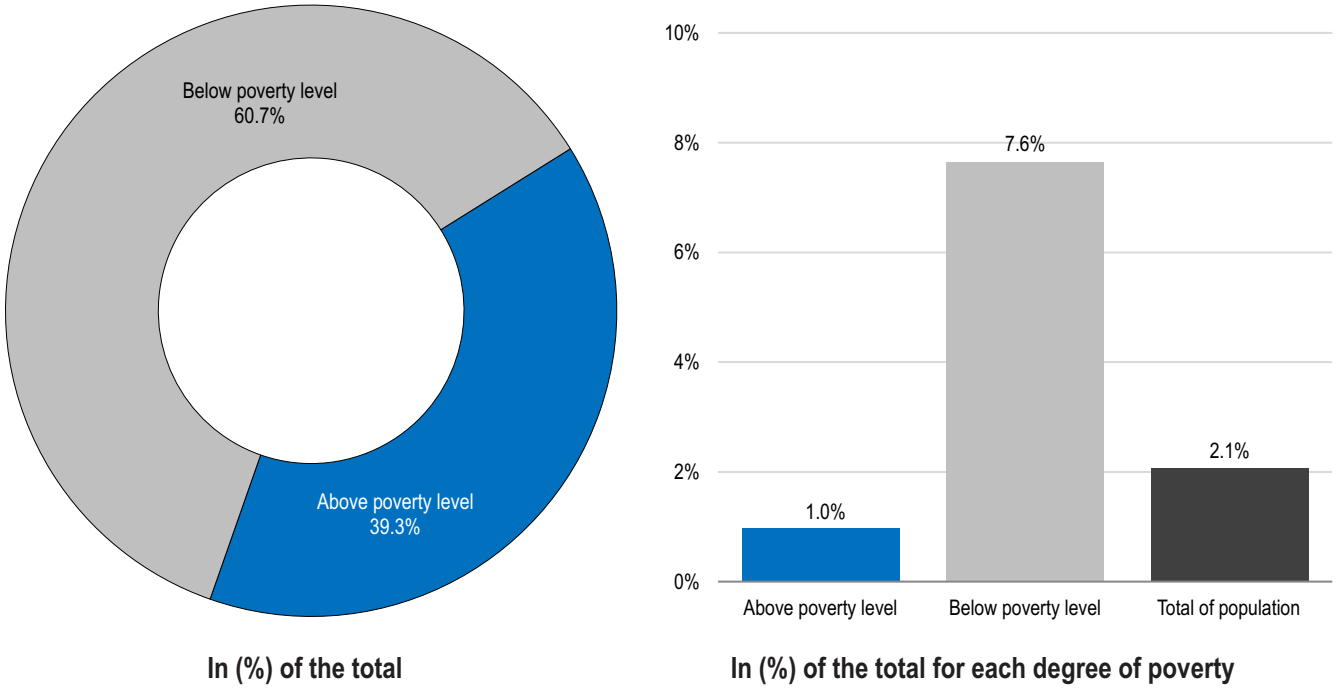
In (%) of the total



In (%) of the total of each household monthly income range

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 6.14
Distribution of the population without toilet for the exclusive use of the household by degree of poverty and relative frequency, Brazil, 2022



In (%) of the total

In (%) of the total for each degree of poverty

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Where are the largest affected populations?

		in thousands of people
1	Pará	983.5
2	Maranhão	916.1
3	Bahia	540.0
4	Amazonas	353.9
5	Piauí	335.5
6	Pernambuco	281.8
7	Ceará	251.1
8	Acre	139.0
9	Paraíba	135.5
10	Alagoas	130.9
11	Minas Gerais	94.0
12	Rio Grande do Norte	49.6
13	São Paulo	42.8
14	Sergipe	39.5
15	Tocantins	21.7
16	Paraná	21.0
17	Roraima	15.1
18	Mato Grosso	14.2
19	Rondônia	11.0
20	Santa Catarina	9.2
21	Rio Grande do Sul	8.9
22	Amapá	6.9
23	Rio de Janeiro	6.3
24	Mato Grosso do Sul	1.4
25	Distrito Federal	0.8
26	Espírito Santo	0.8
27	Goiás	0.7

Where is this problem most common?

In (%) of population		
15.4%	Acre	1
12.8%	Maranhão	2
11.2%	Pará	3
10.2%	Piauí	4
8.5%	Amazonas	5
3.9%	Alagoas	6
3.6%	Bahia	7
3.3%	Paraíba	8
2.9%	Pernambuco	9
2.7%	Ceará	10
2.5%	Roraima	11
1.7%	Sergipe	12
1.4%	Rio Grande do Norte	13
1.3%	Tocantins	14
0.8%	Amapá	15
0.6%	Rondônia	16
0.4%	Minas Gerais	17
0.4%	Mato Grosso	18
0.2%	Paraná	19
0.1%	Santa Catarina	20
0.1%	São Paulo	21
0.1%	Rio Grande do Sul	22
0.1%	Mato Grosso do Sul	23
0.0%	Rio de Janeiro	24
0.0%	Distrito Federal	25
0.0%	Espírito Santo	26
0.0%	Goiás	27

7

DEPRIVATION OF ACCESS TO THE GENERAL SEWAGE COLLECTION SYSTEM

7.1 Regional distribution

According to PNADC statistics, 22.832 million dwellings lacked access to the general sewage collection system in 2022. This figure represents 30.8% of all homes in Brazil.

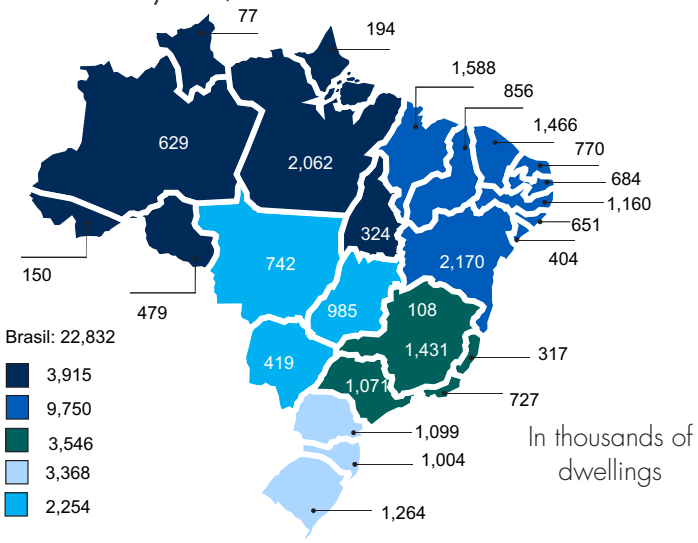
In 2022, 42.7% of households without access to sewage collection were in the Northeast Region, totaling 9.750 million homes. Among states in that region, the highest concentration of dwellings with this deprivation was in the states of Maranhão, Piauí, and Rio Grande do Norte. In the Northeast Region, 18.4% of all dwellings were not connected to sewage collection.

In the North Region, the problem was also quite severe, with 3.915 million dwellings lacking sewage collection, or 17.1% of the national total. In this case, however, the share that these dwellings represent of the total number of dwellings was even higher than in the Northeast Region: 69 out of every 100 households had no sewage collection in 2022. In that region, the biggest problems were in the states of Pará and Amazonas, where there were 2.062 million and 629,000 homes, respectively, not collected to public sewage collection systems. In relative terms, almost 80% of the dwellings in the state of Pará and 54% in the state of Amazonas were affected by the lack of sewage collection.

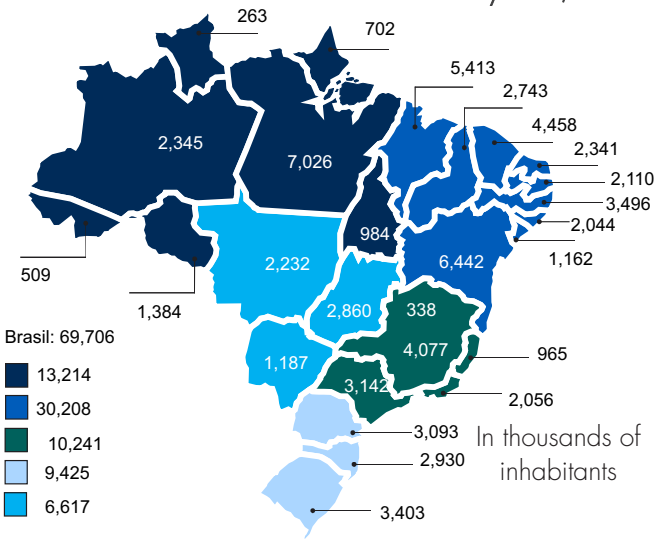
In the Southeast Region, 3.546 million homes had no sewage collection, or 15.5% of all dwellings in Brazil in this situation. In relative terms, the problem is still severe in the states of Espírito Santo and Minas Gerais, where 21.8% and 18.8% of dwellings, respectively, lacked sewage services in 2022. The South and Center-West regions had 14.7% and 9.9%, respectively, of all dwellings lacking sewage collection. In relative terms, the situation in Mato Grosso was quite severe, with 62.6% of state homes not connected to the public sewage collection system.

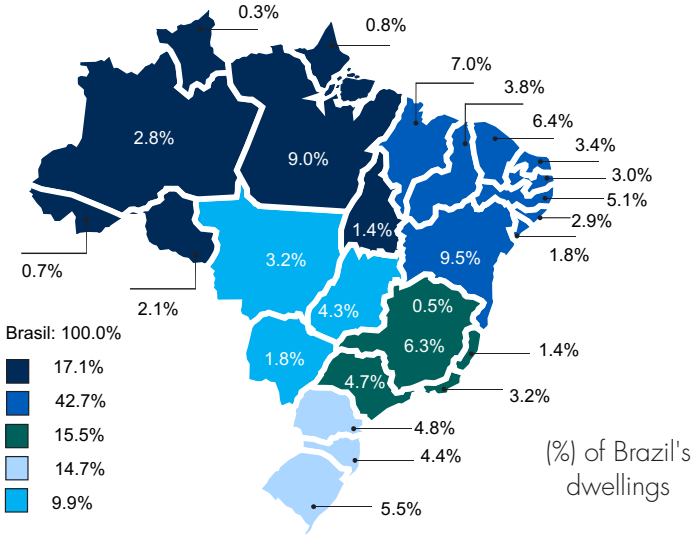
The number of Brazilians living in homes lacking sewage services in 2022 was 69.706 million people. This represented 32.5% of the country's population. In terms of population, most of the problem (43.3%) was also located in Brazil's northeastern states, totaling 30.208 million people in 2022. The highest concentration of people deprived of sewage services was in the states of Maranhão, Bahia, and Ceará. In Maranhão, close to 76 out of every 100 dwellings were not connected to the public sewage collection system.

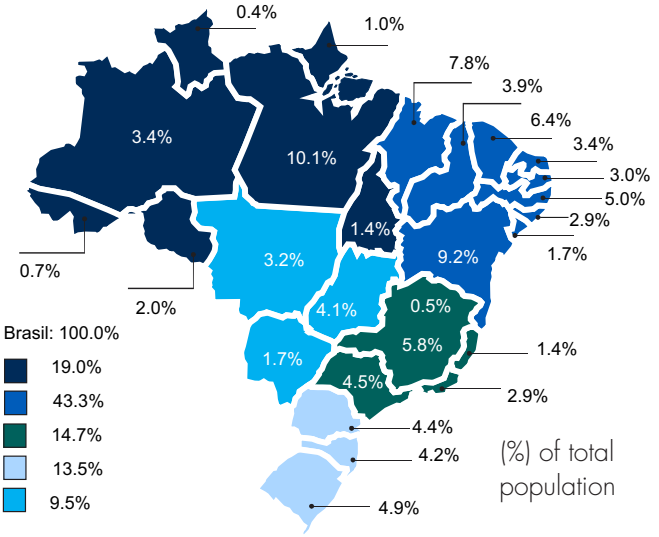
Map. 7.1 Number of dwellings with deprivation of access to the general sewage collection system, 2022

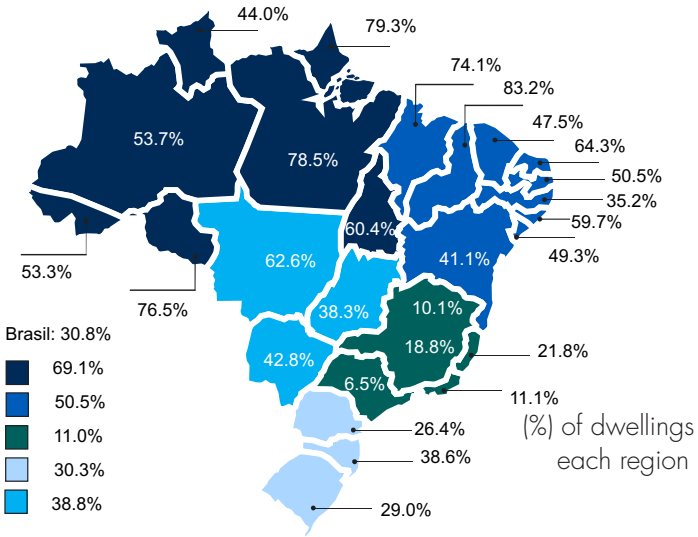


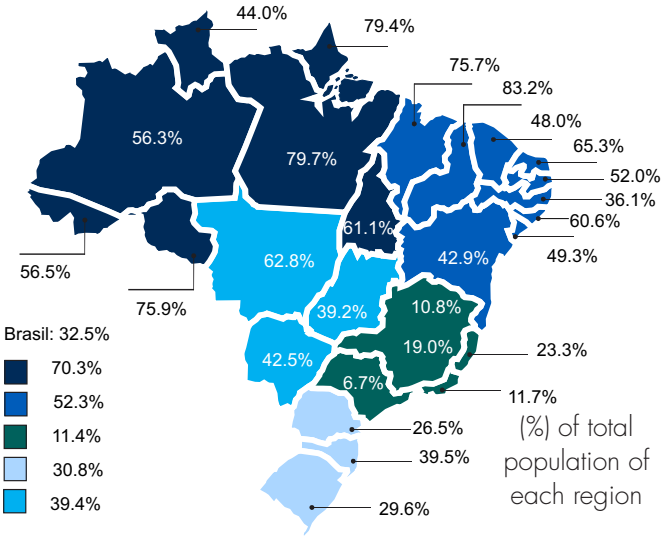
Map. 7.2 Number of population with deprivation of access to the general sewage collection system, 2022











Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Table 7.1
Distribution of dwellings and population by rural and urban areas and portions of dwellings and populations with deprivation of access to the general sewage collection system, Brazil, 2022

	Urban	Rural	Total
		Dwellings	
(%) of deprived homes out of total homes	62.7%	37.3%	100.0%
% of dwellings	22.1%	90.9%	30.8%
		Population	
(%) of deprived population out of total population	50.4%	49.6%	100.0%
(%) of population in each area	33.6%	31.5%	32.5%

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

In the North Region, the problem was also severe, with 13.214 million people living in homes without sewage services. This figure represents 19.0% of the national total. In comparison to the Northeast, the proportion was even higher, with 70 out of every 100 people lacking sewage collection in their homes. In the North Region, the biggest problems were again in the states of Pará and Amazonas, where there were 7.026 million and 2.345 million homes, respectively, not collected to public sewage collection systems. In relative terms, this deprivation impacted nearly 80% of the population of Pará and 56.3% of that in Amazonas.

Of the total number of Brazilian dwellings lacking sewage collection in 2022, 62.7% were in urban areas and 37.3% in rural areas. In relative terms, 90.9% of rural homes lacked sewage collection. This is due to the difficulties and high cost of collecting and transporting sewage in remote regions. It is worth noting that in rural areas this is not as serious a problem as it is in urban areas, as there are a small number of houses very far apart. In population terms, the distribution was similar: 50.4% of the population without sewage collection lived in the urban areas of Brazilian cities, while 49.6% of the people without sewage collection lived in rural areas. Accordingly, the percentage of the total population in each region that lacked public sewage services ended up being slightly higher among urban dwellers.

6.2. Changes over time

Between 2013 and 2022, the number of homes lacking sewage collection fell from 24.0 million to 22.831 million, indicating that 1.166 million homes were no longer in this situation. The rate of decline was 0.6% per year, accumulating a 4.9% reduction between 2013 and 2022 in the number of dwellings not connected to the general sewage collection system. In relative terms, the percentage of deprived dwellings fell from 36.7% of all dwellings in 2013 to 30.8% of all dwellings in Brazil in 2022. This amounted to a reduction of 6 percentage point.
In population terms, historical data point to a slight downward trend in the number of dwellings not connected to the general sewage collection system. Between 2013 and 2022, the number of people in deprivation fell from 78.286 million to 69.706 million, indicating that more than 8.580 million people were lifted out of deprivation of this basic sanitation service. The rate of decline was 1.3% per year, accumulating a 11.0% reduction between 2013 and 2022 in the number of people living in homes not served by sewage collection. In relative

Chart 7.1
Evolution of housing with deprivation of access to the general sewage collection system, Brazil

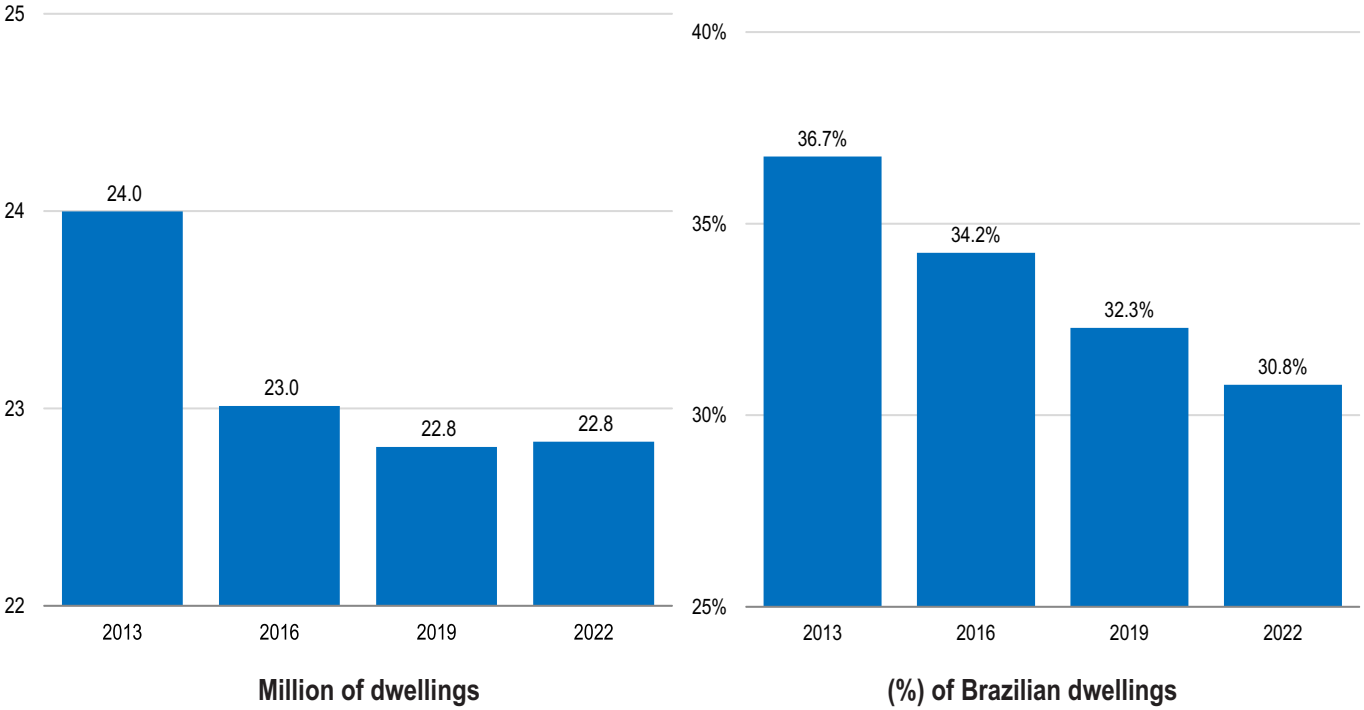
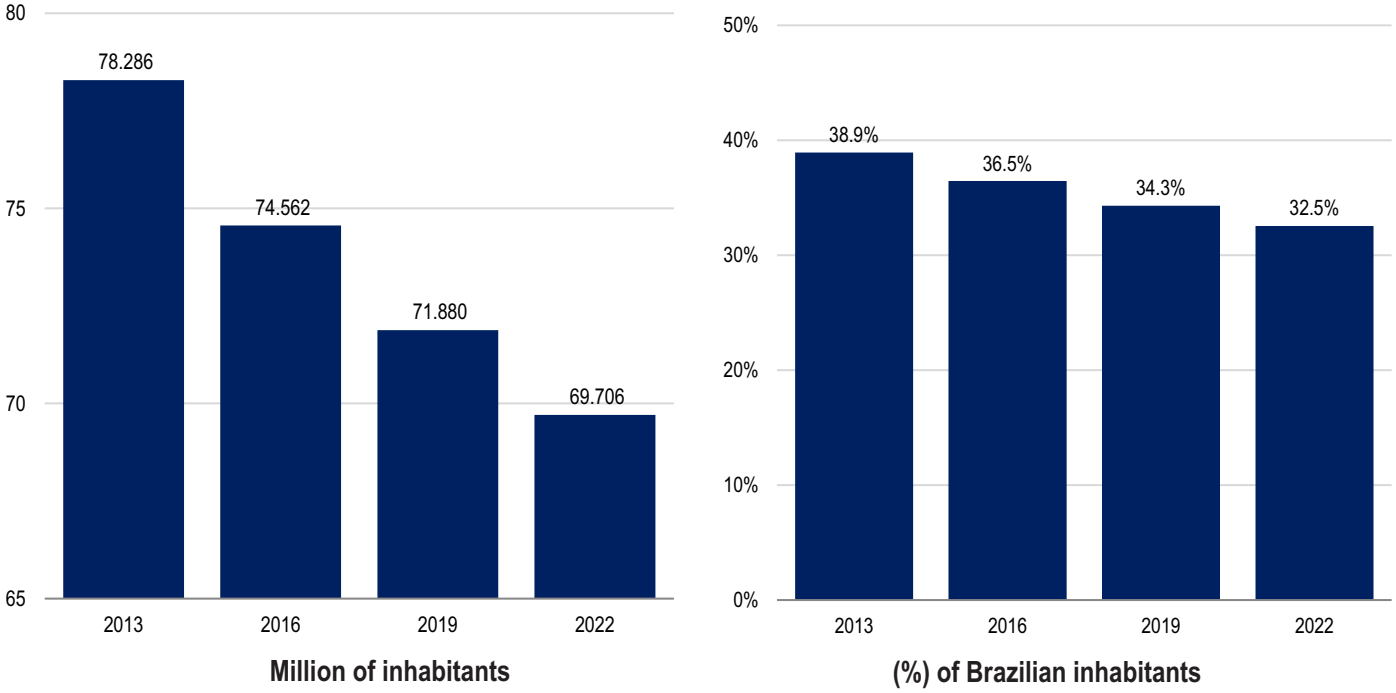


Chart 7.2
Evolution of population with deprivation of access to the general sewage collection system, Brazil



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

terms, the percentage of people in deprivation fell from 38.9% of the Brazilian population in 2013 to 32.5% of Brazilians in 2022.

6.3. Profile of deprived homes

Most dwellings not connected to the general sewage collection network were houses. Apartments with this characteristic accounted for only 2.2% of the total 22.831 million dwellings deprived of water storage tanks in 2022, while rooming houses represented 0.2%. In relative terms, not having sewage collection also impacted houses the most: 35 out of every 100 dwellings facing this situation were houses. In the case of rooming houses, 31 out of every 100 were in this condition in 2022.

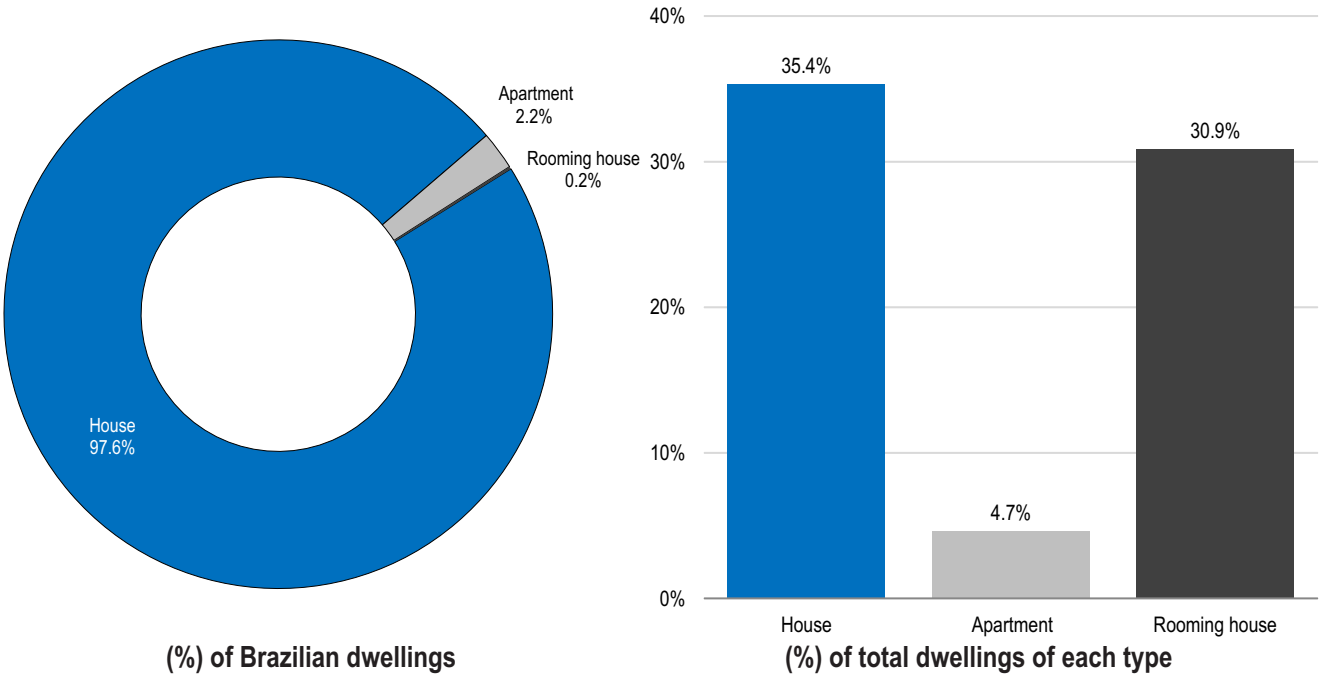
Graph 7.4 shows that the problem of lack of sewage services by a general network was more acute among dwellings with inadequate finishing materials. For example, of all the houses made of uncoated rammed earth, 89.4% were deprived of public sewage services. For dwellings built from scavenged wood and other similar material, the figure was 66.2% and 69.6%, respectively. Only 27.6% of the houses made of coated masonry had no sewage collection services in 2022.

If we look at the roofing material of the dwellings, we see a similar picture. The proportion of dwellings lacking sewage collection was relatively higher in dwellings with corrugated metal sheets or other types of roofs, such as scavenged wood and thatch. The lack of toilets was less frequent in houses with concrete-slab and tiled roofs.

In dwellings with dirt floors, the proportion of homes not connected to the sewage system was extremely high (90.2%). The share of homes deprived of public sewage collection was also relatively high in dwellings featuring cement floors, 63.8%.

The problem of dwellings not being connected to the general sewage collection system is also associated with garbage collection. This meant that the proportion of dwellings not served by sewage collection was relatively higher in households where waste was burned on the property (95.2%), buried on the

Chart 7.3
Distribution of dwellings with deprivation of access to the general sewage collection system by type of housing and relative frequency, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 7.4
Relative frequency of dwellings with deprivation of access to the general sewage collection system by wall material, Brazil, 2022

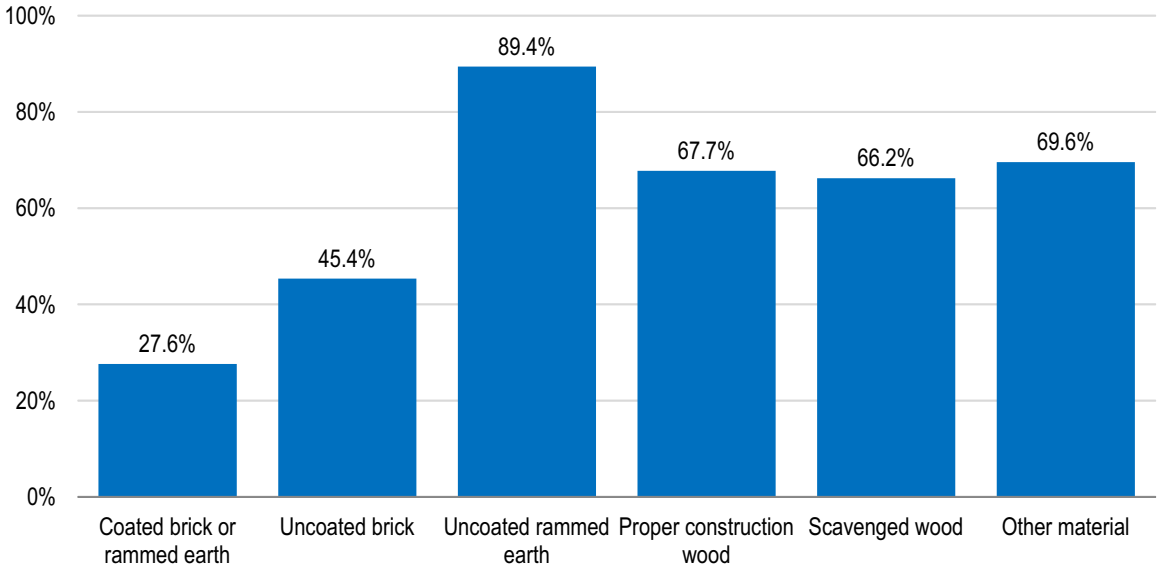
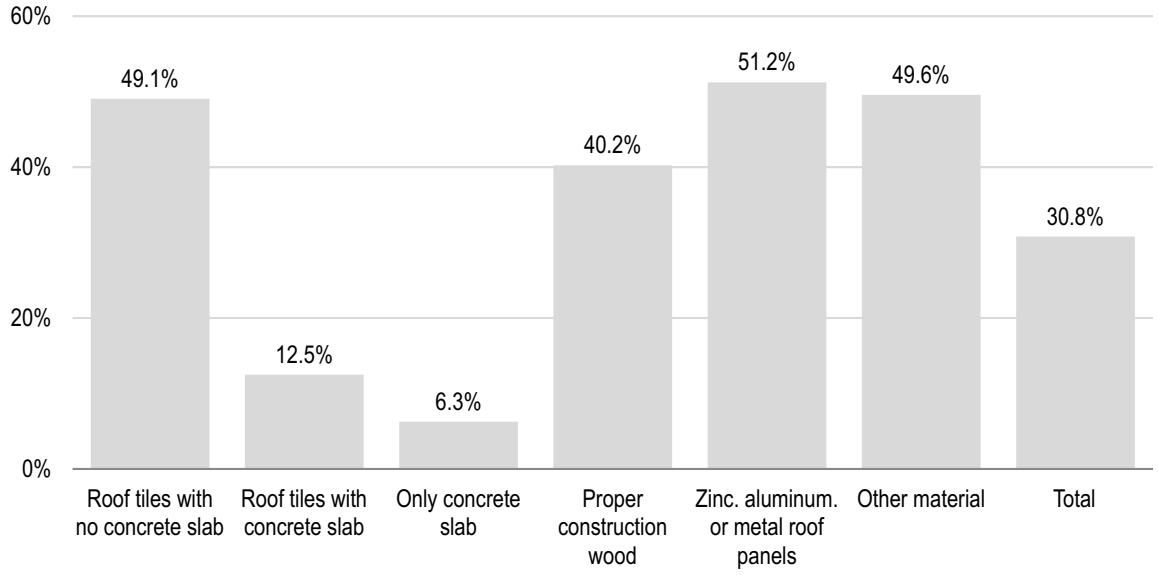


Chart 7.5
Relative frequency of dwellings with deprivation of access to the general sewage collection system by roofing material, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 7.6
Relative frequency of dwellings with deprivation of access to the general sewage collection system by floor material, Brazil, 2022

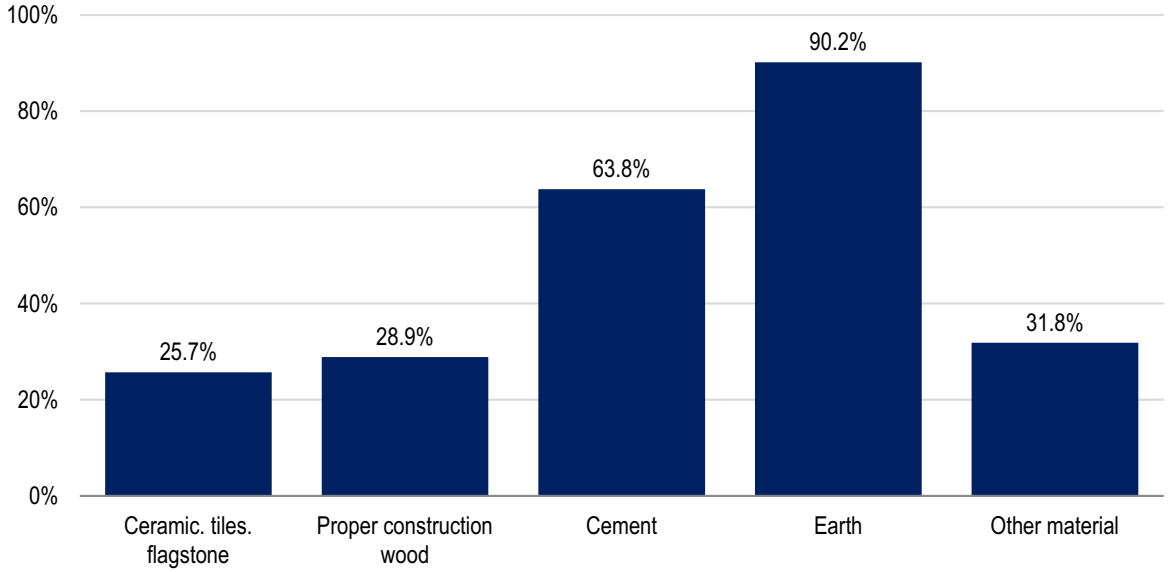
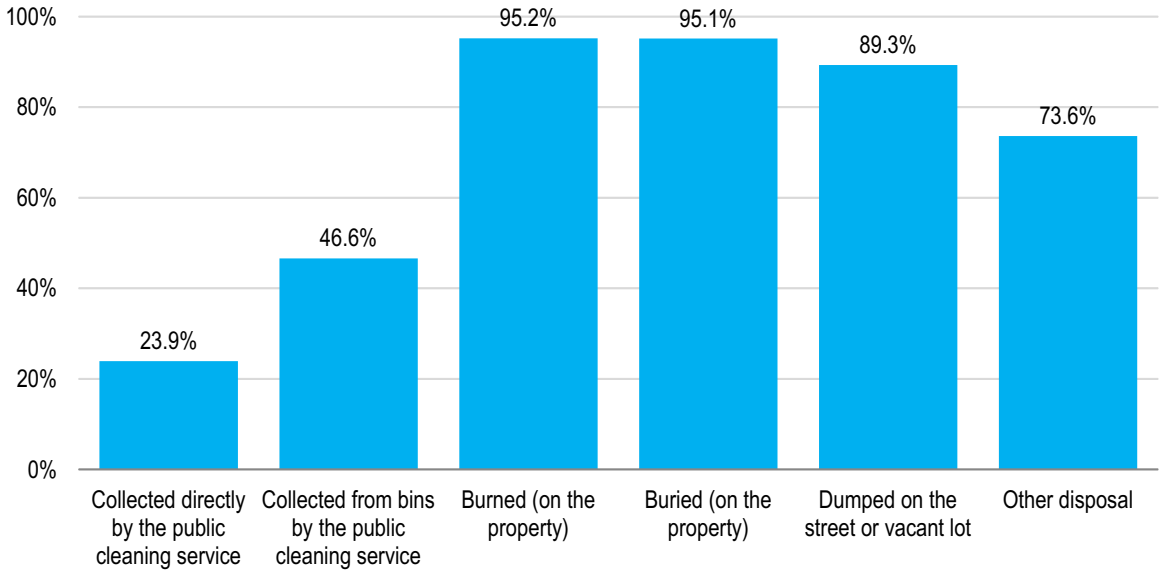


Chart 7.7
Relative frequency of dwellings with deprivation of access to the general sewage collection system by waste destination, Brazil, 2022



Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

property (95.1%), or dumped on a vacant property (89.3%). In homes where garbage is collected directly or is collected in bins by the public cleaning service, the problem of no sewage collection services was less frequent.

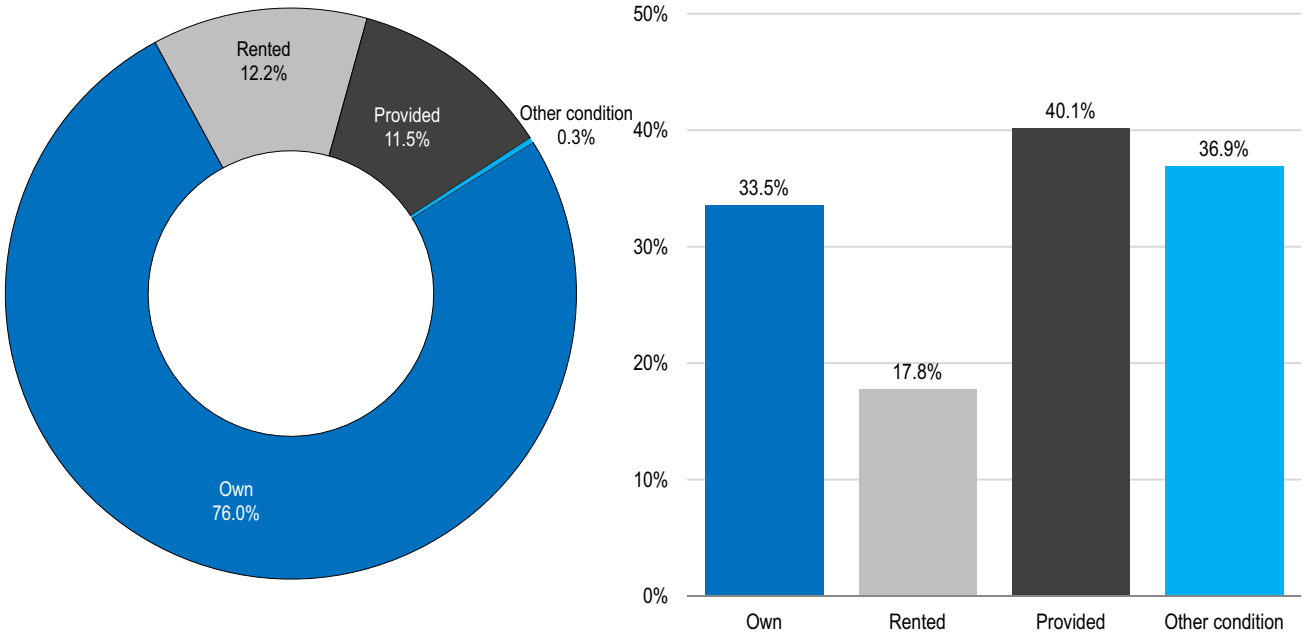
The vast majority of dwellings lacking sewage services was owner-occupied (76.0%) and another high proportion was rented (12.2%). However, a higher relative frequency of dwellings deprived of sewage collection was identified in dwellings provided by an employer. A total of 40.1% of employer-provided dwellings lacked proper sewage collection, while in the case of owned dwellings, this rate was 33.5% in 2022.

6.4. Deprived population profile

Of the 69.706 million people living in dwellings lacking access to a general sewage collection network in 2022, 50.4% were men and 49.6% were women. In relative terms, the frequency of men in this housing condition was 33.6% and the frequency of women was 31.5%, resulting in a weighted average frequency of 32.5% of the total population.

In relative terms, the frequency of the population without access to sewage collection services was quite different according to age group. We observed that this frequency was higher in the younger age groups. Among the population aged up to 4 years, 36.2% lived in dwellings not served by sewage collection. This rate was even higher in the 15-19 age group, 37.7%. As age progresses, the relative frequency of the population facing this situation fall gradually. For the group of people aged 80 and over, this rate was 27.6%. This fact suggests that the problem of lack of sewage collection is also heavily concentrated on Brazil's younger population and on families with a larger number of children.

Chart 7.8
Distribution of dwellings with deprivation of access to the general sewage collection system by property ownership and relative frequency, Brazil, 2022



In (%) of the total

In (%) of the total for each type of property ownership

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

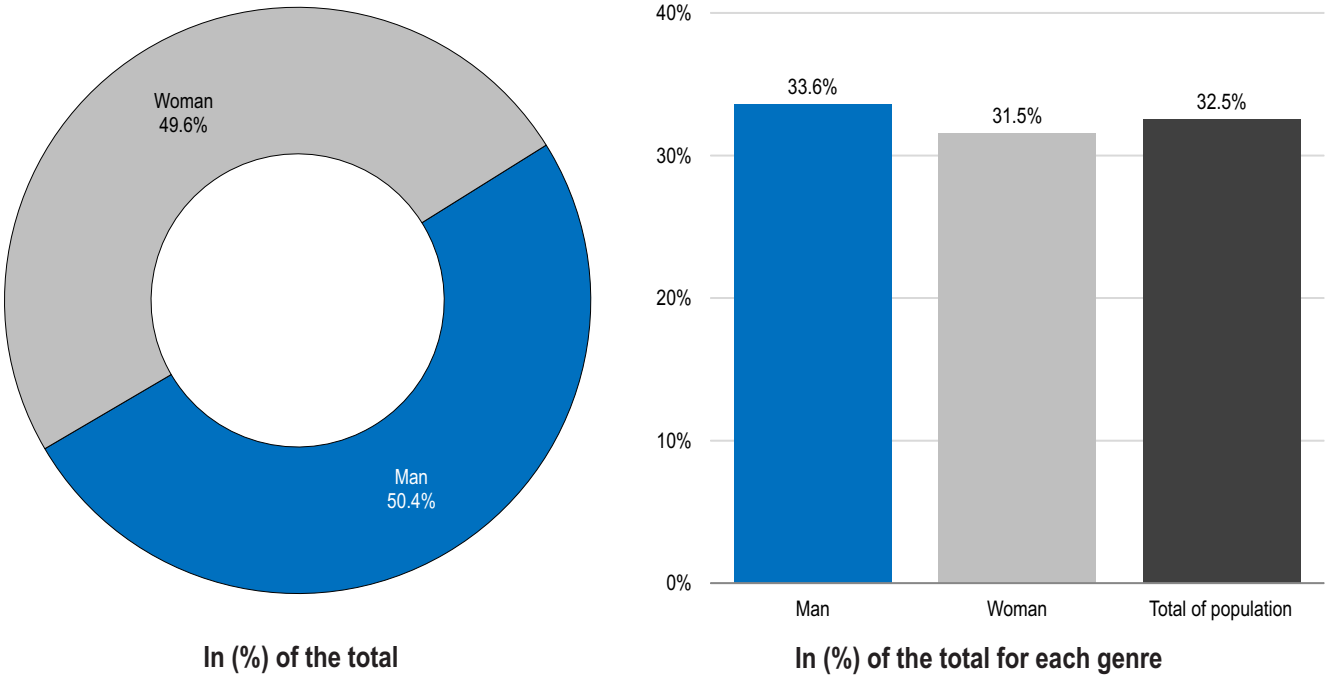
Of the total number of people deprived of access to sewage collection services in 2022, 56.9% declared themselves to be brown. The self-declared white population accounted for 31.8% and the self-declared black population another 10.1%. In relative terms, however, the highest frequency occurred in the indigenous population, where 44,6 out of every 100 people had no sewage collection. The frequency is also higher in the brown demographic group (40.9%).

From an educational point of view, most of the population deprived of sewage collection had not completed elementary school (41.3%) or had completed middle school (22.2%). The proportion of the population who had reached higher education was extremely small, at only 2.7% of the total number of people who were deprived of sewage services.

The relative frequency of the population deprived of sewage collection by a general network varied widely by education level. This frequency was higher in the less educated groups. Among the uneducated population, 45.2% lived in dwellings not served by public sewage collection. This rate steadily fell in the more educated populations, reaching 15.3% for the demographic group who graduated from college.

The distribution of the population lacking sewage collection by monthly household income bracket shows a strong concentration of low-income households. In 2022, 43.9% of the total of 69.7 million people with this deprivation lived in households where the total income was at most R$2,400.00 per month. A further 31.9% of people in deprivation lived in households with a monthly income of between R$2,400.01 and R$4,400.00. These two income classes accounted for almost 76.3% of the population deprived of private toilets in their homes. In relative terms, we observed that as income increased, the frequency of people deprived of access to the general sewage collection service fell.

Chart 7.9
Distribution of the population with deprivation of access to the general sewage collection system by gender and relative frequency, Brazil, 2022



In (%) of the total

In (%) of the total for each genre

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Chart 7.10
Relative frequency of the population with deprivation of access to the general sewage collection system by age group, Brazil, 2022

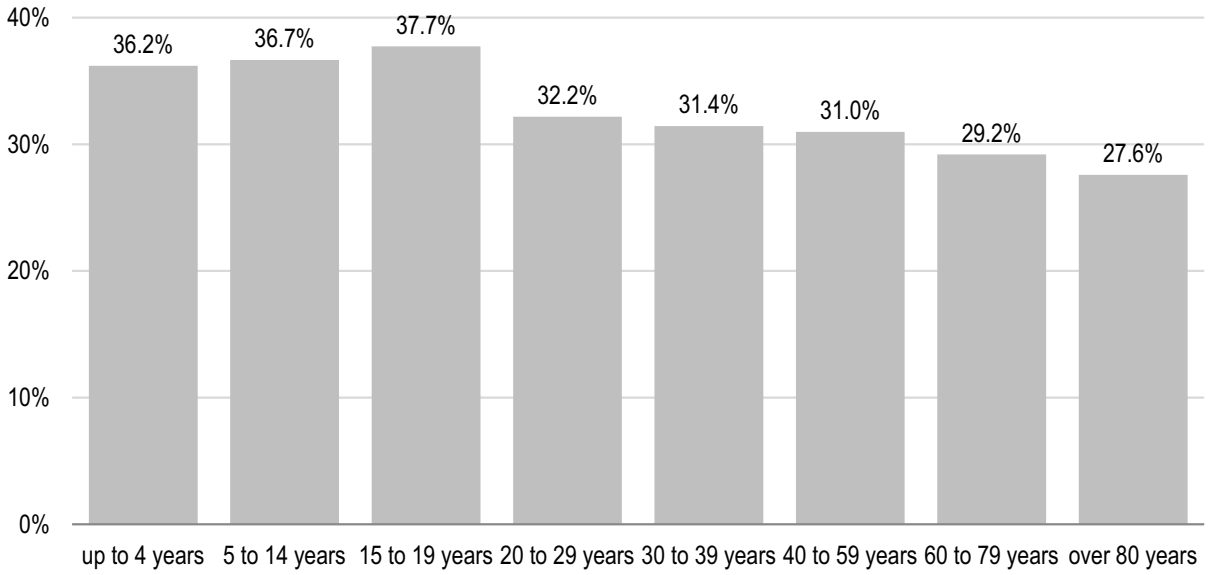
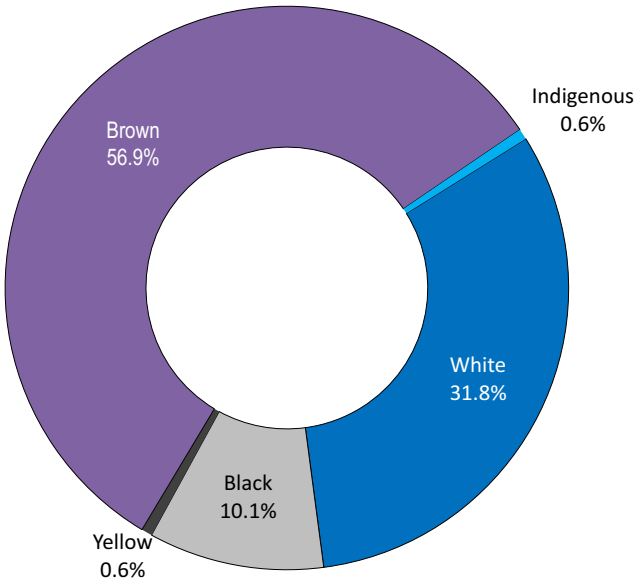
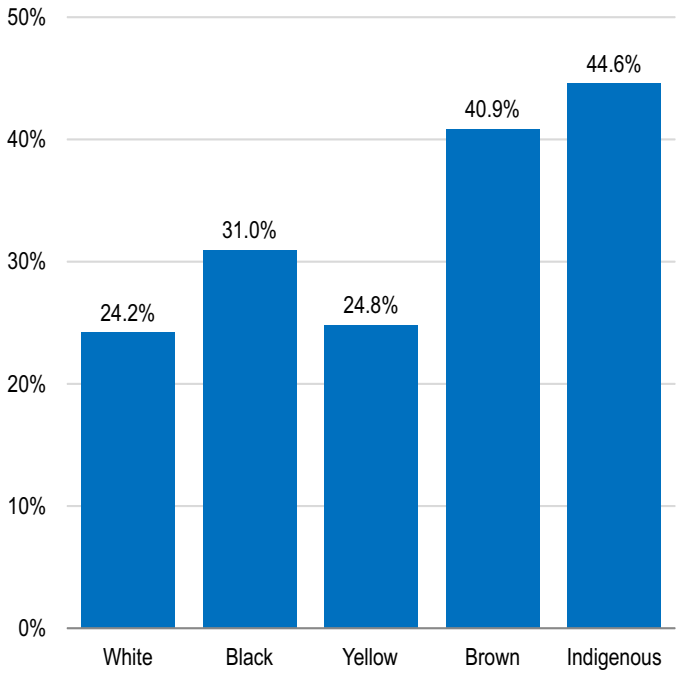


Chart 7.11
Distribution of the population with deprivation of access to the general sewage collection system by self-declared race and relative frequency, Brazil, 2022



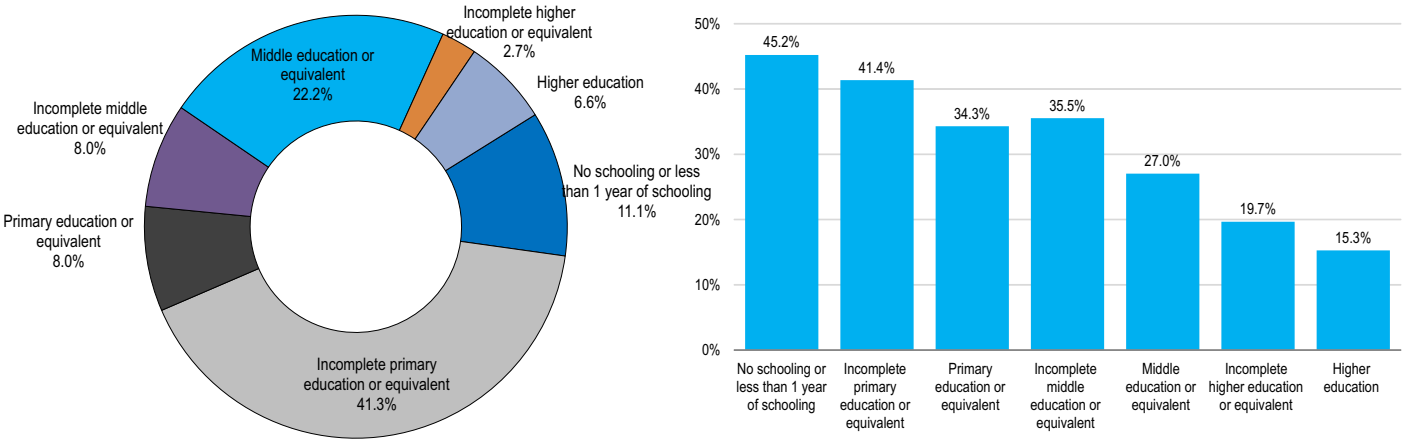
In (%) of the total



In (%) of the total of each self-declared race

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

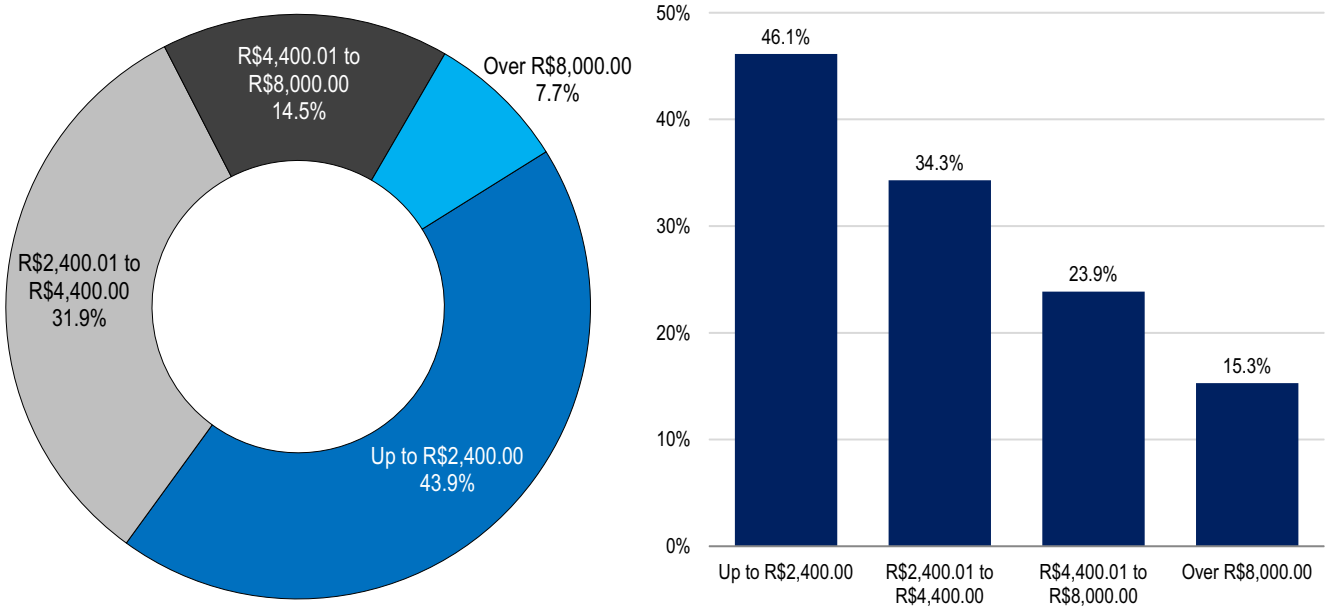
Chart 7.12
Distribution of the population with deprivation of access to the general sewage collection system by level of education and relative frequency, Brazil, 2022



In (%) of the total

In (%) of the total of each level of education

Chart 7.13
Distribution of the population with deprivation of access to the general sewage collection system by household monthly income range and relative frequency, Brazil, 2022



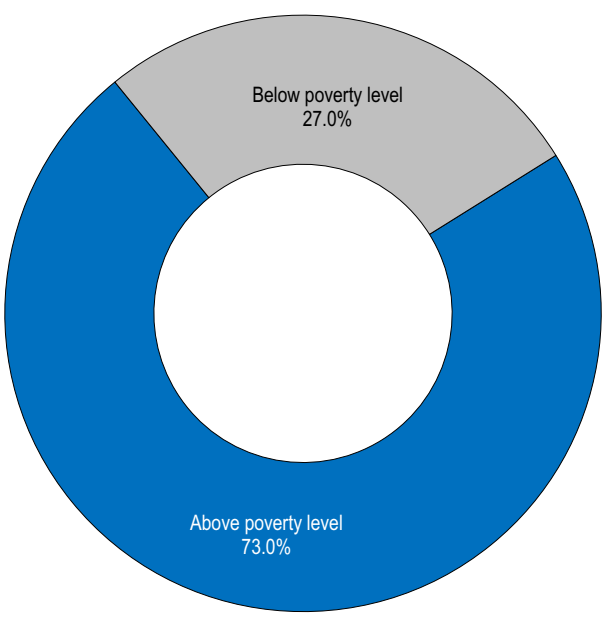
In (%) of the total

In (%) of the total of each household monthly income range

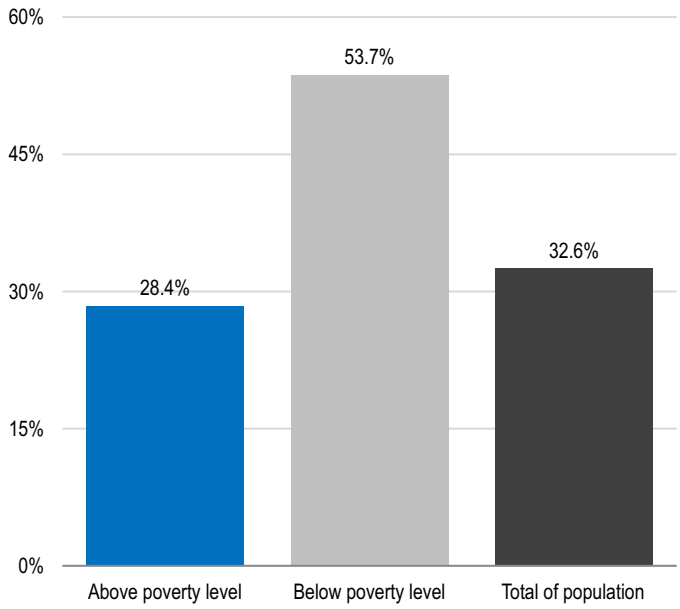
Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Lastly, the analysis identified that 27.0% of the population living in dwellings lacking sewage service were below the poverty line in 2022. In terms of relative frequency, 53,7% of people living below the poverty line were not served by sewage collection services in 2022.

Chart 7.14
Distribution of the population with deprivation of access to the general sewage collection system by degree of poverty and relative frequency, Brazil, 2022



In (%) of the total



In (%) of the total for each degree of poverty

Source: PNADC. Elaboration: Ex Ante Consultoria Econômica.

Where are the largest affected populations?

		in thousands of people
1	Pará	7,026
2	Bahia	6,442
3	Maranhão	5,413
4	Ceará	4,458
5	Minas Gerais	4,077
6	Pernambuco	3,496
7	Rio Grande do Sul	3,403
8	São Paulo	3,142
9	Paraná	3,093
10	Santa Catarina	2,930
11	Goiás	2,860
12	Piauí	2,743
13	Amazonas	2,345
14	Rio Grande do Norte	2,341
15	Mato Grosso	2,232
16	Paraíba	2,110
17	Rio de Janeiro	2,056
18	Alagoas	2,044
19	Rondônia	1,384
20	Mato Grosso do Sul	1,187
21	Sergipe	1,162
22	Tocantins	984
23	Espírito Santo	965
24	Amapá	702
25	Acre	509
26	Distrito Federal	338
27	Roraima	263

Where is this problem most common?

In (%) of population		
83.2%	Piauí	1
79.7%	Pará	2
79.4%	Amapá	3
75.9%	Rondônia	4
75.7%	Maranhão	5
65.3%	Rio Grande do Norte	6
62.8%	Mato Grosso	7
61.1%	Tocantins	8
60.6%	Alagoas	9
56.5%	Acre	10
56.3%	Amazonas	11
52.0%	Paraíba	12
49.3%	Sergipe	13
48.0%	Ceará	14
44.0%	Roraima	15
42.9%	Bahia	16
42.5%	Mato Grosso do Sul	17
39.5%	Santa Catarina	18
39.2%	Goiás	19
36.1%	Pernambuco	20
29.6%	Rio Grande do Sul	21
26.5%	Paraná	22
23.3%	Espírito Santo	23
19.0%	Minas Gerais	24
11.7%	Rio de Janeiro	25
10.8%	Distrito Federal	26
6.7%	São Paulo	27


8

HEALTH IMPLICATIONS

The lack of treated water or the exposure to sewage in the environment, both problems resulting from the lack of sanitation, have a decisive impact on the incidence of diseases affecting the health of children, adolescents, and adults. The lack of treated water, whether due to lack of access to the general distribution network, irregular supply, or simply the inability to store it in homes, has a direct impact on the health of the population, especially the young and the elderly, as it increases the incidence of gastrointestinal infections. The lack of water also affects respiratory diseases, as hand hygiene is a very effective way to reduce the likelihood of transmitting these diseases. It is worth noting that access to treated water benefits the oral health of the population, especially the poorest who lack proper dental care.

The lack of sewage collection and treatment services is responsible for another share of gastrointestinal infections. The most serious problems arise on the banks of contaminated rivers and streams or on streets where sewage flows in the open – in ditches, gutters, streams, or rivers. But it is also present in the pollution of large public water reservoirs and springs whose quality has deteriorated over the years.

In general, the recurrence of these infections harms society by causing irrecoverable costs. Poor sanitation is related to these costs in two ways:

i. By increasing the incidence of infections, the lack of sanitation causes people to miss work, resulting in costs to society in terms of hours not worked; and

ii. Society incurs public and private costs for the treatment of infected individuals.

As a result of these health problems, workers miss days of work and young people miss school, which affects their performance. An absence from work of about five days due to infectious respiratory or gastrointestinal diseases has a high impact on the monthly income of a self-employed person. A self-employed housecleaner, street vendor, or bricklayer who works on a contract basis and does not have social security coverage can lose 20% of their monthly income due to a health problem like this. In young people, the incidence of these illnesses hinders progress at school and affects performance, with long-term compromises to the human capital acquired.

This chapter analyzes the impacts of deprivation of sanitation on the occurrence of waterborne diseases, respiratory diseases, and oral health.

8.1. Waterborne diseases

In 2019, it is estimated that there were a total of 43.374 million cases of sick leave due to waterborne diseases in Brazil. The estimate was based on information from the 2019 National Health Survey (IBGE, 2020). Among many other questions, this health survey asked a representative sample of the Brazilian population whether they had been absent from routine activities in the two weeks prior to the interview, the reason for the absence, and the number of days they were absent.

These reports indicate an incidence rate of 206.9 cases per thousand inhabitants in 2019 in Brazil. These incidence rates were higher in the North, Northeast and Center-West regions, as shown in Map 8.1. In the Northeast, the incidence rate reached 238.1 cases per 1,000 inhabitants and in the North, 204.4 cases per 1,000 people. As discussed in the last five sections of this study, these were generally the regions with the worst sanitation.

Based on microdata from the 2019 National Health Survey (IBGE, 2020), which includes a wide range of information about people, their homes, and the occurrence or lack of absences, we observed that the probability of absence from daily activities due to waterborne diseases was positively correlated with indicators of lack of access to the treated water supply network, lack of a toilet, and lack of access to the sewage collection network.

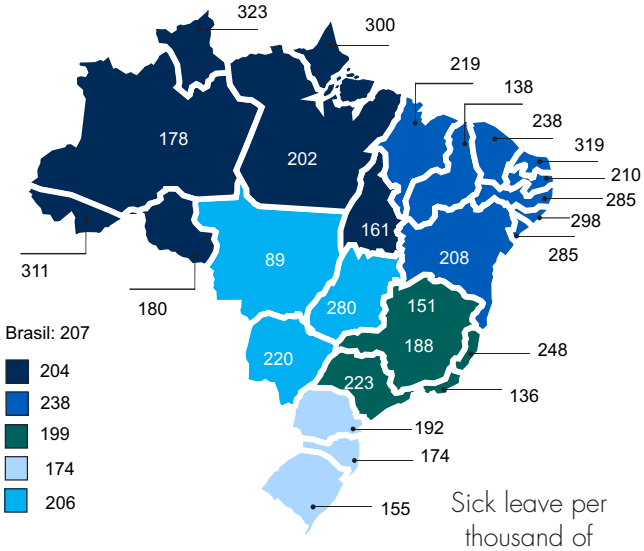
As seen in Table 8.1, people living in homes with poor sanitation are significantly more likely to miss work or school as a result of waterborne diseases. The coefficients associated with lack of access to the water distribution network, deprivation of a toilet, and lack of access to the sewage collection services are positive and statistically significant, indicating that people deprived of these services are more exposed to acute gastrointestinal infections and diseases caused by insect vectors. The statistical model indicates that a family without access to a sewage system, for example, has a 24.0% greater chance of contracting waterborne diseases. It is worth noting that this is the deprivation with the greatest impact on this type of disease. Lack of access to a water distribution network leads to a 5.2% higher risk of contracting waterborne diseases, and lack of a toilet leads to a 12.1% higher risk. The statistical modeling methodology is detailed in the Methodology Appendix.

In 2019, according to the National Health Survey (IBGE, 2020), 41.0% of people on sick leave reported being bedridden due to waterborne diseases. This equated to approximately 80 million days spent in bed by the Brazilian population due to waterborne diseases.

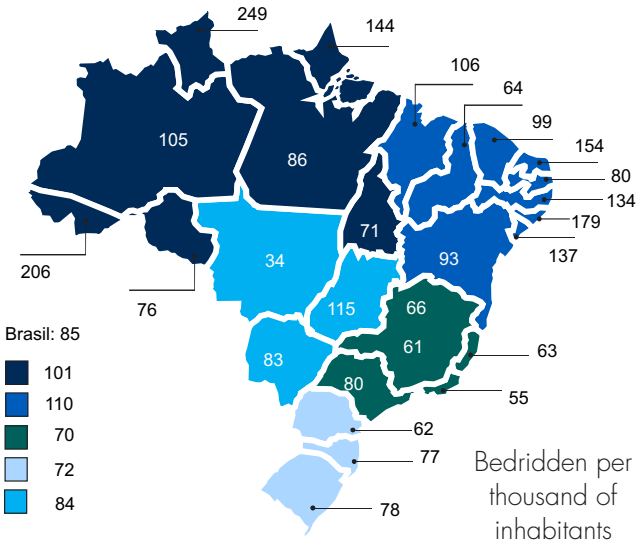
Based on information from the Brazil's Unified Health System (SUS), there were 273,400 hospitalizations due to waterborne diseases throughout 2019. The country average was 13.0 hospitalizations per 10,000 inhabitants. The North and Northeast regions also had higher rates than the national average.

The negative consequences of the lack of sanitation on the health of the population are serious, as we have seen, but the progress made in the treatment and distribution of purified water and the collection and treatment of sewage are producing visible results. According to data from the National Sanitation Information System (SNIS), only 45.4% of the Brazilian population had access to the general sewage collection network in 2010. That year, there were 603,600 hospitalizations for waterborne diseases in SUS facilities, which indicated an incidence rate of 31.6 cases per 10,000 inhabitants. In 2021, the percentage of people with access to a sewage collection system had risen to 55.8% of the population. The number of hospitalizations fell to 128,900, indicating a reduction in the incidence rate to 6.0 cases per 10,000 inhabitants. This indicates an 80.9% reduction in the incidence rate of hospitalizations due to waterborne diseases in Brazil over these 11 years. Graph 8.1 shows the negative relationship between the incidence rate of

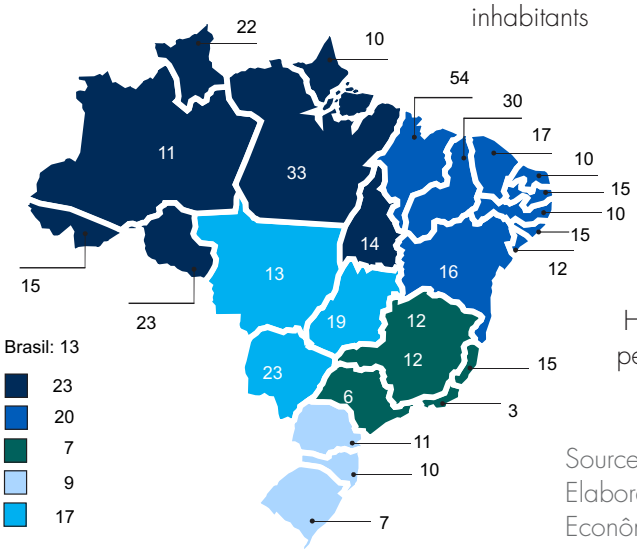
Map 8.1
Incidence rates due to waterborne diseases, 2019



Sick leave per thousand of inhabitants



Bedridden per thousand of inhabitants



Hospitalization* per 10 thousands of inhabitants

Source: IBGE and SNIS.
Elaboration: Ex Ante Consultoria Econômica.

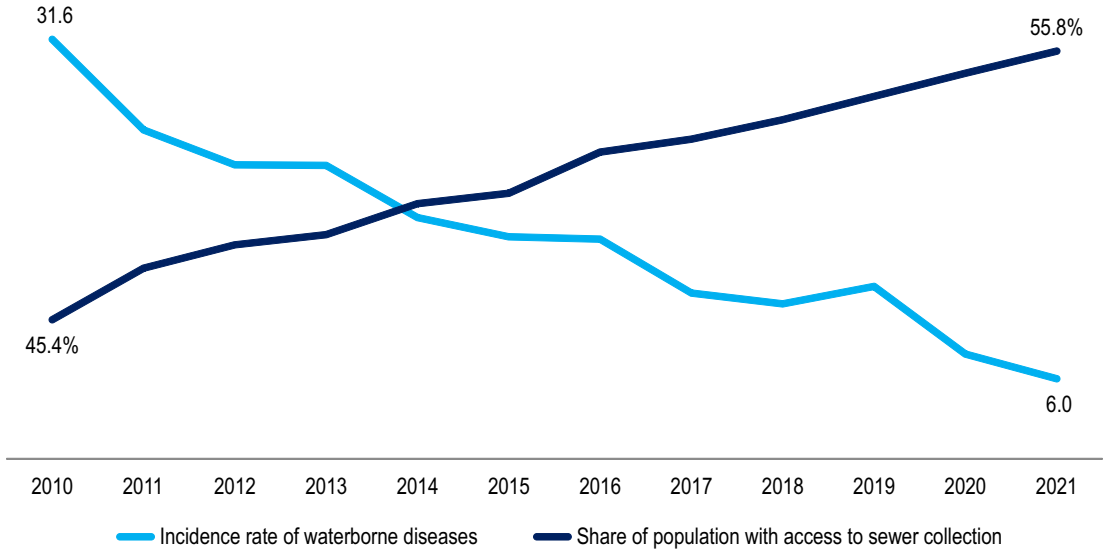
(*) These diseases are classified in the ICD 10 group, which includes: cholera, typhoid and paratyphoid fevers, shigellosis, amoebiasis, diarrhea and gastroenteritis presumed infectious origin, other intestinal infectious diseases, icterohemorrhagic leptospirosis, other forms of leptospirosis, unspecified leptospirosis, yellow fever, dengue fever, dengue virus hemorrhagic fever, plasmodium falciparum malaria, plasmodium vivax malaria, plasmodium malariae malaria, other forms of malaria confirmed by parasitological tests, unspecified malaria and schistosomiasis.

Table 8.1
Effects of deprivation of sanitation on sick leave due to waterborne diseases, Brazil, 2019

Dimensão	β	desvio padrão	z	*p*-valor	razão de problabilidade
Privação de acesso à rede de abastecimento de água tratada	0.0510	0.0063	8.11	0.0%	5.2%
Privação de banheiro	0.1146	0.0077	14.88	0.0%	12.1%
Privação de acesso à rede de coleta de esgoto	0.2153	0.0068	31.72	0.0%	24.0%

Source: PNS. Elaboration:Ex Ante Consultoria Econômica.

Graph 8.1
Incidence rates of hospitalization due to waterborne diseases and deprivation of access to the general sewage collection system, Brazil, 2010 to 2021



Source: IBGE, SNIS and DATASUS. Elaboration: Ex Ante Consultoria Econômica.

hospitalization for waterborne diseases and the reduction in deprivation of access to a sewerage system between 2010 and 2021.

8.2. Respiratory diseases

In addition to waterborne diseases, the lack of sanitation affects the incidence of respiratory diseases. The most direct link between lack of sanitation and respiratory diseases is access to hand hygiene. Ryan et al (2001) analyzed the effect of handwashing instructions on the incidence of respiratory diseases in the US military population undergoing training between 1996 and 1998. The group that received instructions and unrestricted access to water and hygiene products had a 45% lower incidence than the group of soldiers without instructions or access to water and hygiene materials. Rabie and Curtis (2006) provide an extensive review of studies published up to 2004. These studies concluded that hand washing reduced the incidence of respiratory illness by 6% to 44%.

Based on information from the 2019 National Health Survey (IBGE, 2020), it is also possible to estimate the number of people who take time off from their routine activities due to respiratory diseases. In 2019, it is estimated that there were a total of 92.130 million cases of sick leave due to respiratory diseases in Brazil. These reports indicate an incidence rate of 439.6 cases per thousand inhabitants in 2019 in Brazil.

These incidence rates were also higher in the North and Northeast regions, which have the poorest sanitation. In the Northeast, the incidence rate reached 520.0 cases per 1,000 inhabitants and in the North, 523.3 cases per 1,000 people.

Based on microdata from the 2019 National Health Survey (IBGE, 2020), which details a wide range of information about people and their homes and the occurrence or lack of sick leaves, we find that the likelihood of being absent from daily activities due to respiratory illness is associated with indicators of sanitation deprivation. Table 8.2 shows that the population living in dwellings without access to water is significantly more likely to miss work or school due to respiratory diseases. The coefficients associated with lack of access to a water distribution network and deprivation of a toilet are positive and significant, suggesting that people deprived of these

services are more exposed to flu and pneumonia. The coefficient associated with lack of access to a sewage system was not significant, indicating that this deprivation does not affect the incidence of respiratory diseases.

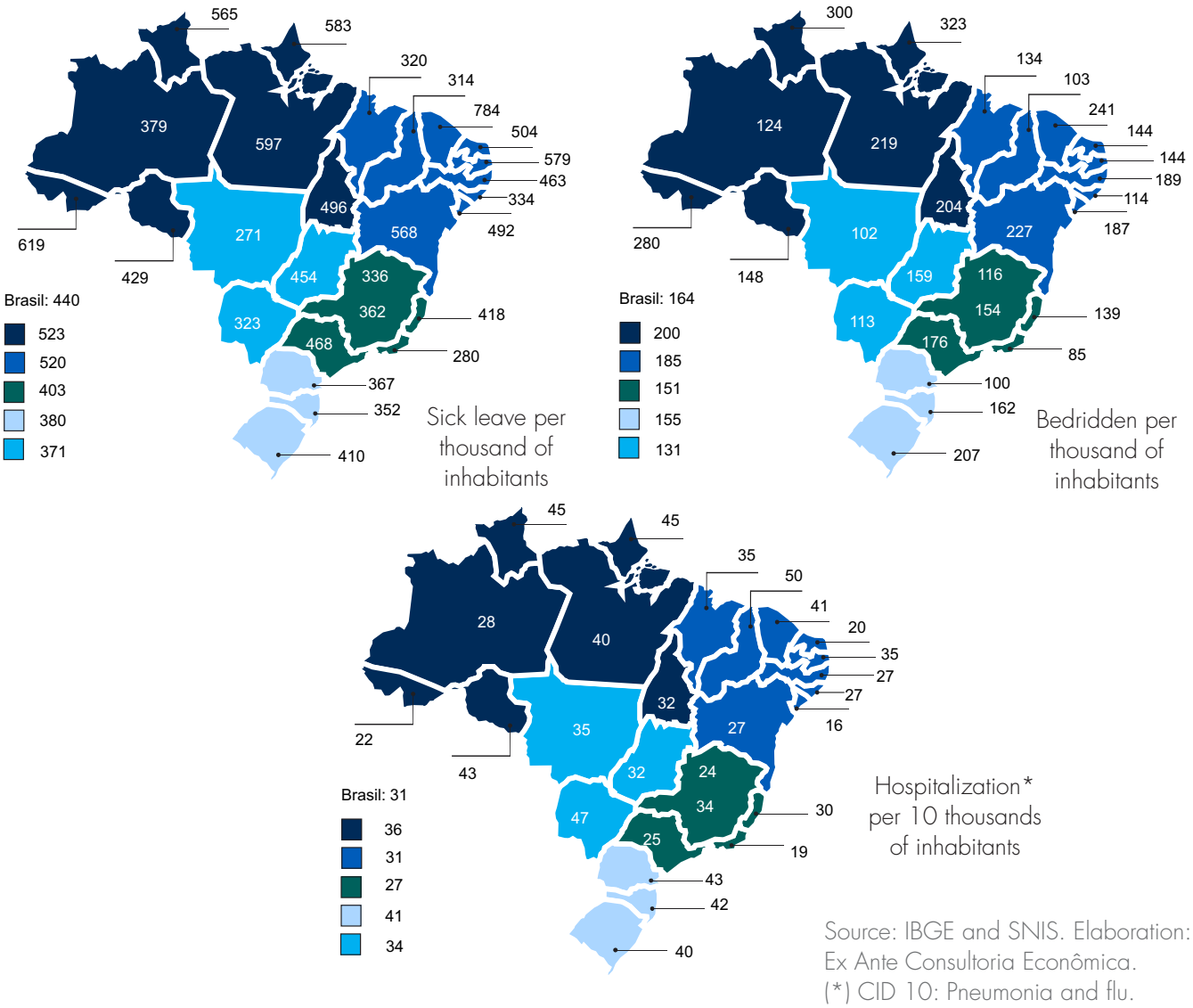
The statistical model indicates that a family deprived of access to treated water has a 9.5% greater chance of contracting respiratory diseases. It is worth noting that this is not the deprivation with the greatest impact on this type of disease. Deprivation of a toilet, another facility that makes handwashing possible, makes people 11.6% more likely to contract respiratory diseases. The statistical modeling methodology of these diseases is also detailed in the Methodology Appendix.

In 2019, according to the National Health Survey (IBGE, 2020), 37.2% of people on sick leave reported being bedridden due to respiratory diseases. This equated to approximately 140 million days spent in bed by the Brazilian population due to respiratory diseases.

Based on information from the Brazil's Unified Health System (SUS), there were 657,600 hospitalizations due to respiratory diseases throughout 2019. Here too we have a concentration of cases in the North Region, but the worst rates are in the south of Brazil due to climatic factors.

In line with the discussion on waterborne diseases, advances in water treatment and distribution have brought visible results in the reduction of respiratory diseases. As deprivation of access to treated water fell, so did the incidence rates of respiratory diseases. There was a reduction from 41,400 cases per 10,000 inhabitants in 2010 to 16,200 hospitalizations per 10,000 inhabitants in 2021. This indicates an 60.7% reduction in the incidence rate of hospitalizations due to respiratory diseases in Brazil over these 11 years. Graph 8.2 shows the negative relationship between the incidence rate of hospitalizations for respiratory diseases and access to treated water between 2010 and 2021. It is worth noting that the years 2020 and 2021 are out of line due to the Covid-19 pandemic. During that time period, hospitalizations for these illnesses decreased as a result of the general population wearing masks.

Map 8.2 Incidence rates due to respiratory diseases, 2019



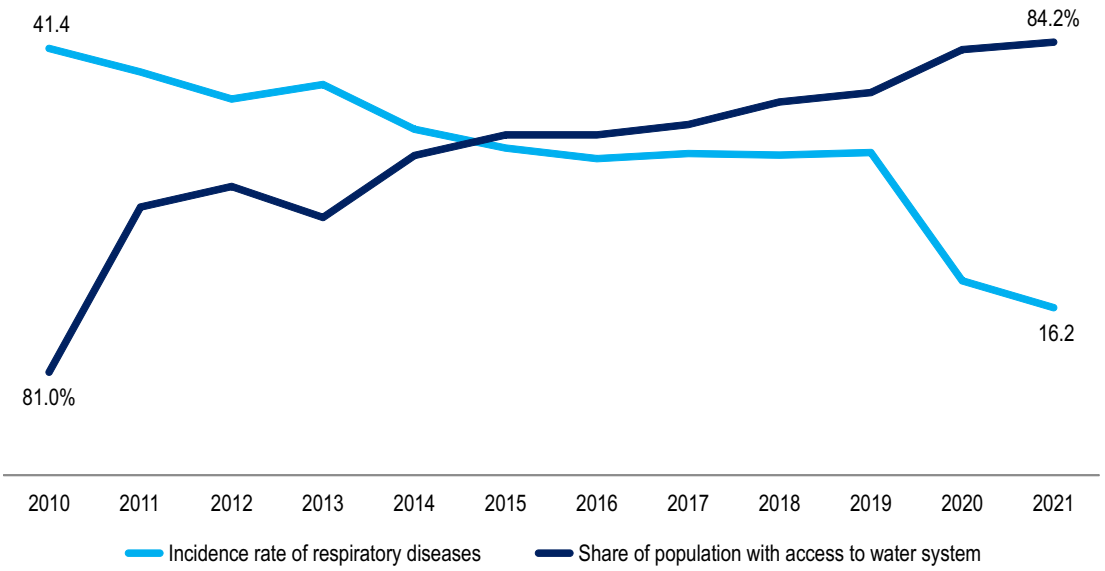
Source: IBGE and SNIS. Elaboration: Ex Ante Consultoria Econômica.
(*) CID 10: Pneumonia and flu.

Table 8.2
Effects of deprivation of sanitation on sick leave due to respiratory diseases, Brazil, 2019

Dimension	β	standard deviation	z	p-value	reason for the probability
Deprivation of access to treated water supply	0.0510	0.0063	8.11	0.0%	5.2%
Lack of toilet	0.1146	0.0077	14.88	0.0%	12.1%
Deprivation of access to sewage collection	0.2153	0.0068	31.72	0.0%	24.0%

Source: PNS. Elaboration: Ex Ante Consultoria Econômica.

Graph 8.2
Incidence rates of hospitalization due to respiratory diseases and deprivation of access to the general water system, Brazil, 2010 to 2021



Source: IBGE, SNIS and DATASUS. Elaboration: Ex Ante Consultoria Econômica.

8.3. Oral diseases

As with the diseases analyzed above, the lack of sanitation has an impact on the incidence of oral diseases. Similarly to respiratory diseases, the most direct link between lack of sanitation and oral diseases is access to the hygiene process, in this case of the mouth. Deprivation of sanitation restricts the potential for oral hygiene with effects on the incidence of dental caries, early tooth decay, and the occurrence of oral cancer. Good references on the subject and the discussion of the determining factors of oral diseases, including the lack of sanitation, are Ismail and Sohn (2001), Petersen (2008), and Northridge et al (2020).

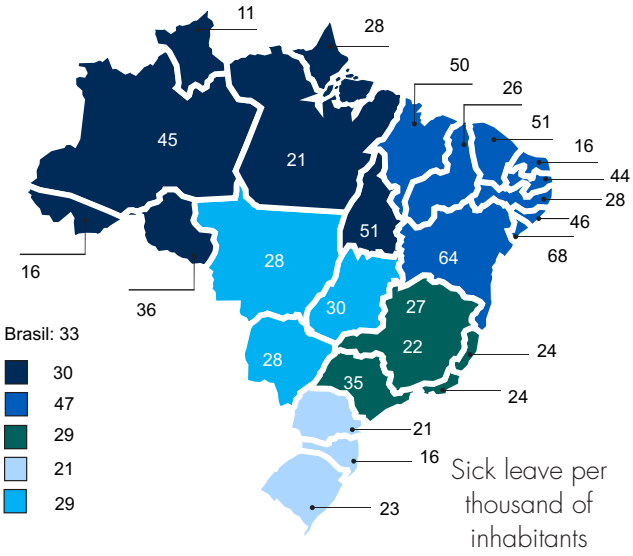
Based on information from the 2019 National Health Survey (IBGE, 2020), we estimated the number of people who take time off from their routine activities due to oral diseases. In 2019, it is estimated that there were a total of 6.864 million cases of sick leave due to oral diseases in Brazil. These reports indicate an incidence rate of 32.7 cases per thousand inhabitants in 2019 in Brazil.

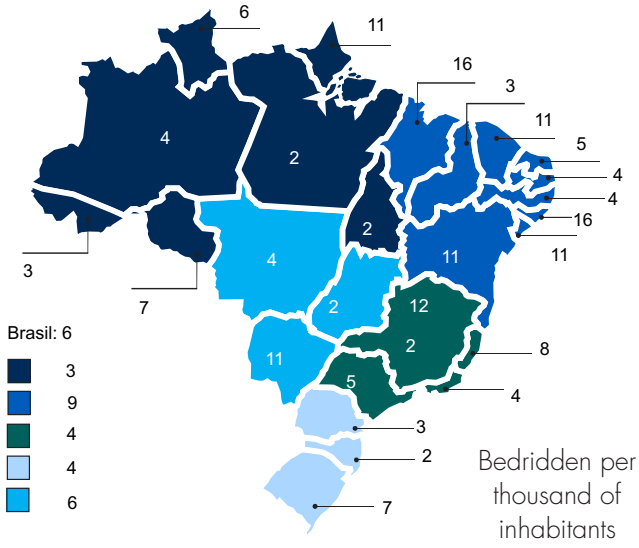
Again, these incidence rates were also higher in the North and Northeast regions, which have the poorest sanitation. In the Northeast, the incidence rate reached 56.9 cases per 1,000 inhabitants and in the North, 30.2 cases per 1,000 people.

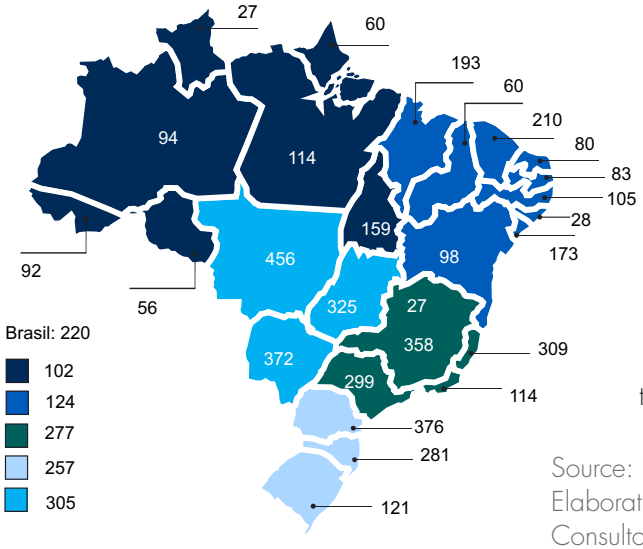
Based on microdata from the 2019 National Health Survey (IBGE, 2020), it was found that the probability of absence from daily activities due to oral diseases was associated with deprivation indicators. Table 8.3 shows that the population living in dwellings without access to water is also significantly more likely to miss work or school due to oral diseases. The coefficients associated with lack of access to the water distribution network, deprivation of a toilet and deprivation of access to sewage collection are all positive and statistically significant, indicating that people deprived of these services are more exposed to oral problems in general.

The statistical model indicates that a family deprived of access to the treated water network is almost twice as likely to contract oral diseases as a family with access to the general treated water distribution

Map 8.3
Incidence rates due to oral diseases, 2019







Source: IBGE and SNIS. Elaboration: Ex Ante Consultoria Econômica.

Table 8.3
Effects of deprivation of sanitation on sick leave due to oral diseases, Brazil, 2019

Dimension	β	standard deviation	z	p-value	reason for the probability
Deprivation of access to treated water supply	0.6762	0.0121	55.81	0.0%	96.6%
Lack of toilet	0.1154	0.0170	6.79	0.0%	12.2%
Deprivation of access to sewage collection	0.5938	0.0136	43.56	0.0%	81.1%

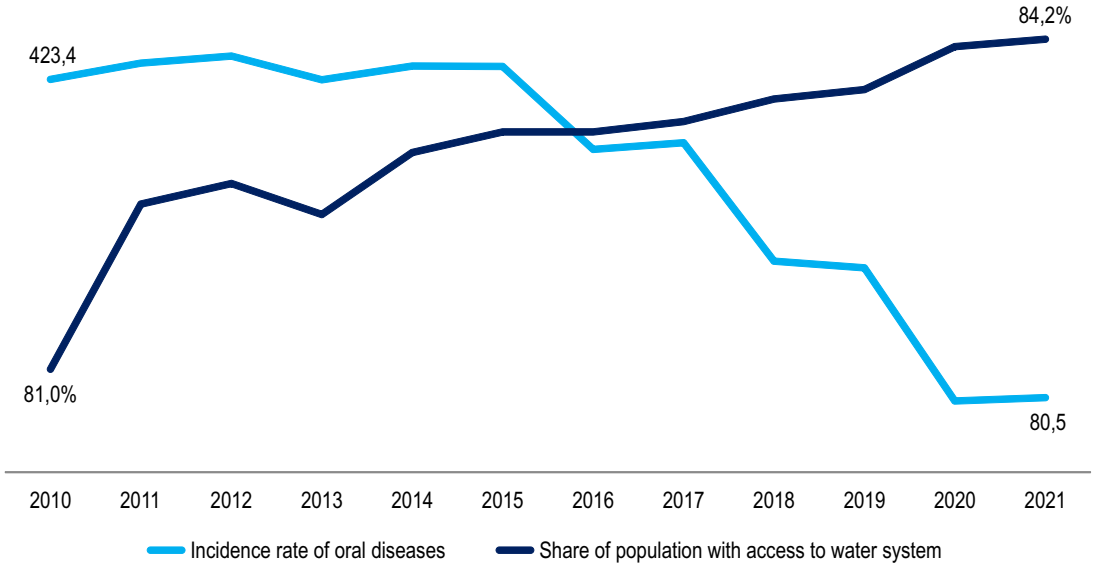
Source: PNS. Elaboration: Ex Ante Consultoria Econômica.

system. This is the deprivation with the greatest impact on this type of disease. Deprivation of a toilet, another facility that makes oral hygiene possible, makes people 12.2% more likely to contract oral diseases. Deprivation of access to the collection network also has a high effect. The statistical modeling methodology of oral diseases is also detailed in the Methodology Appendix.

In 2019, according to the National Health Survey (IBGE, 2020), only 0.8% of people on sick leave due to oral diseases said they were bedridden. But based on information from the Unified Health System (SUS), there were 46.018 million outpatient dental visits due to oral problems throughout 2019. In this case, unlike hospitalizations due to waterborne or respiratory diseases, there is a concentration of cases in regions where there is a more developed network of these services, such as the Southeast and Center-West.

Similarly to what has been discussed about other diseases, the advance of water distribution has brought visible results in the reduction of dental care. As deprivation of access to treated water fell, so did the rate of outpatient dental care per 1,000 inhabitants in the SUS network. There was a reduction from 432,400 visits in 2010 to 80,500 visits in 2021. This indicates an 80.9% drop in the volume of outpatient dental care in Brazil over these 11 years. Graph 8.3 shows the negative relationship between the number of services per 1,000 inhabitants and access to treated water between 2010 and 2021. It's worth noting that the years 2020 and 2021 are also out of line due to the Covid-19 pandemic. During this period, the general population avoided visits to the dentist.

Graph 8.3
Incidence rates of hospitalization due to oral diseases and deprivation of access to the general water system, Brazil, 2010 to 2021



Source: IBGE, SNIS and DATASUS. Elaboration: Ex Ante Consultoria Econômica.


9

ANNEXES

1. BIBLIOGRAPHICAL REFERENCES

DATASUS. *Informações de Saúde* (TABNET). Ministério da Saúde, Brasília, 2021.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. *Pesquisa Nacional de Saúde de 2019*. Rio de Janeiro, 2020.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. *Pesquisa Nacional por Amostra de Domicílios de 2013*. Rio de Janeiro, 2014.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. *Pesquisa Nacional por Amostra de Domicílios de 2016*. Rio de Janeiro, 2017.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. *Pesquisa Nacional por Amostra de Domicílios de 2019*. Rio de Janeiro, 2020.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. *Pesquisa Nacional por Amostra de Domicílios de 2022*. Rio de Janeiro, 2023.

INSTITUTO TRATA BRASIL. *Saneamento, Educação, Trabalho e Turismo. Centro de Políticas Sociais* CPS-FGV, São Paulo, 2008.

INSTITUTO TRATA BRASIL. *Benefícios econômicos e sociais da expansão do saneamento no Brasil*. São Paulo, novembro de 2022.

INSTITUTO TRATA BRASIL. *Painel Saneamento Brasil*. Acesso on line: https://www.painelsaneamento.org.br/.

ISMAIL, A.I. e SOHN, W. The impact of universal access to dental care on disparities in caries experience in children. *The Journal of the American Dental Association*, Volume 132, Issue 3, p.295-303, março de 2001.

MINISTÉRIO DO DESENVOLVIMENTO REGIONAL. *Sistema Nacional de Informações sobre Saneamento. Brasília*, 2021.

NORTHRIDGE M.E., KUMAR, A. E KAUR, R. Disparities in Access to Oral Health Care. *Annual Review of Public Health*, p. 513–535, 2020.

PETERSEN, P. E., World Health Organization global policy for improvement of oral health - World Health Assembly 2007. *International Dental Journal*, Volume 58, Issue 3, p.115-121, junho de 2008.

RABIE, T. and CURTIS, V. Handwashing and risk of respiratory infections: a quantitative systematic review. Tropical Medicine and International Health. volume 11 no 3 pp 258–267, março de 2006.

RYAN, M.A.K., CHRISTIAN, R.S. and WOHLRABE, J. Handwashing and Respiratory Illness Among Young Adults in Military Training. American Journal of Preventive Medicine, 21(2), 2001.

WOOLDRIDGE, W. I*ntrodução à econometria: uma abordagem moderna*. Editora Thompson, São Paulo, 2006.

2. SANITATION AND HEALTH

The analysis of the effects of sanitation deprivation on public health began by examining the factors that contribute to the incidence of waterborne diseases (such as diarrhea and vomiting or diseases transmitted by insect vectors), respiratory diseases (such as pneumonia and flu), and oral diseases that cause people to miss their daily activities. The analysis uses the following deprivation variables: lack of access to the treated water network, lack of access to the sewage collection network, and lack of a toilet. In addition to these variables, some socio-economic indicators were used as control variables. The econometric model incorporates the following socioeconomic indicators: (i) individual demographic data, including age, gender, and education; and (ii) household information, such as dwelling type (apartment, house, or room), construction materials used for walls, roof, and floors, geographical location (state, rural or urban area, and specific type of area), presence of a refrigerator, access to garbage collection, ownership of pets, employment of household servants, and per-capita household income. In the study we used data produced by IBGE's 2019 National Health Survey.

A logistic regression model was utilized to determine the probability of absence from work due to one of the three diseases. The probability is represented as a binary variable with a value of 1 indicating absence and 0 indicating no absence. The logistic regression model is described by equation (1):

$$(1) \qquad P(y=1 \mid x_1, x_2, ..., x_k) = G(\beta_0 + \beta_1 x_1 + ... + \beta_k x_k)$$

where y represents the dependent variable (probability of sick day), x_j is information provided by a set of explanatory variables, and $j = 1, 2, \ldots, k$, are coefficients that quantify the relations between these variables and the dependent variable. G is a function that assumes strictly positive values between zero and one: $0 < G(z) < 1$, for all real numbers z. This ensures that the estimated probabilities are strictly between zero and one.

The estimated models used to analyze the impact of three types of sanitation deprivation on the likelihood of missing routine activities due to one of the three diseases yielded satisfactory results. All three types of deprivation have a positive effect on the likelihood of sick leave. Additionally, the remaining control variables exhibited the anticipated trends and demonstrated statistical significance. In the case of respiratory diseases, deprivation of access to the sewage system had no significant effect.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