Water and Sanitation Services in Latin America: Access and Quality Outlook

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Resume: Tracking progress towards the Sustainable Development Goals (SDGs) is critical to evaluate how far the water and sanitation sector is from achieving these targets, and to guarantee that the solutions and strategies implemented get everyone closer to them. But this is not a simple task. To truly assess collective progress towards achieving SDG 6 (and all other goals), it is fundamental to count on standardized measures that help track all types of access, their reliability, and their quality. Existing data tend to lack comparability across sources and locations because they rely on different definitions and categories. Samples are often not representative of all groups within the population. More developed areas are more likely to collect data, which results in the overrepresentation of groups that enjoy better services. Still in some areas and for some categories of information data is not available at all. In response to these challenges, the Inter-American Development Bank (IDB) partnered with the Latin American Public Opinion Project (LAPOP) to gather nationally representative and comparable data in 18 countries in the region. The goal of this effort was to provide an initial outlook of the current landscape of water and sanitation services in the region, using two batteries of questions in the LAPOP questionnaire for the 2018-2019 wave. The main message that arises is that the Latin American and the Caribbean region faces a wide range of challenges, that vary both across and within countries. Some areas face the primary challenge of closing access gaps, while others display higher deficiency in service quality, such as continuity. The gaps in quality of services, in particular, are not clearly perceived by users. In general, levels of satisfaction with the services received is quite high among the population, much higher than warranted by the objective measures of service quality. This raises important issues for accountability in the sector. If users are mostly satisfied with the current state of affairs, it is unlikely they will pressure governments and utilities to improve service delivery. A more in-depth analysis is required to understand the reasons behind these opinions and possible ways to raise awareness.

Keywords: Sustainable Development Goals (SDGs), water and sanitation, service access and quality, Latin America, indicators, survey data, development

JEL Codes: A12, C80, C83, D10, D63, H4, Q0, Q25, Q53, R2

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Water and Sanitation Services in Latin America:

Access and Quality Outlook

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The Sustainable Development Goals (SDGs) and the 2030 Agenda represent a "global blueprint for dignity, peace and prosperity for people and the planet, now and in the future" (UN, 2020). Among these goals, Goal 6 ("Ensure availability and sustainable management of water and sanitation for all") has set ambitious targets for the Water and Sanitation Sector. Tracking progress toward these goals is critical to evaluate how far the sector is from achieving these targets, and to guarantee that the solutions and strategies implemented get everyone closer to them. But this is not a simple task. Water and sanitation services (WSS) involve an enormous variety of alternatives and stakeholders. Water needs might be met through piped networks or through community wells. Wastewater can be treated with septic tanks or collected by local utilities through sewer networks. However, none of these solutions are guaranteed to work properly, ensuring continuity and quality of access. To truly assess collective progress towards achieving SDG 6 (and all other goals), it is fundamental to count on standardized measures that help track all types of access, as well as the reliability and quality of each type of access. Such standardization requires clear definitions and comparable data across all levels and sources of information, from local- to national-level data, and from governmental to consumer-based sources. Achieving such data clarity and comparability calls for a tremendous coordination effort. The current state of available data in the water and sanitation sector illustrates the challenges posed by this complexity. Existing data tend to lack comparability across sources and locations because they rely on different definitions and categories. Samples are often not representative of all groups within the population. More developed areas are more likely to collect data, which results in the overrepresentation of groups that already enjoy better services. Still, in some areas and for some categories of information, data is not available at all.

The lack of adequate data represents a challenge for development in Latin America and the Caribbean. In response to these challenges, the Inter-American Development Bank (IDB) partnered with the Latin American Public Opinion Project (LAPOP) to gather nationally representative and comparable data in 18 countries in the region. The goal of this effort was to provide an initial outlook regarding the current landscape of water and sanitation services in the region, using two batteries of questions in the LAPOP questionnaire for the 2018-2019 wave[1].

1 Within the context of survey research, the Encyclopedia of Survey Research Methods defines wave as: "[...] each separate survey in a series of related surveys. If a survey is conducted only once, then the concept of a "wave" does not apply. It is when a survey is conducted two or more times, for example, once a year for 5 years in a row, that each repeated survey is called a wave". (Encyclopedia of Survey Research Methods, 2008)

The first battery, added to the core questionnaire for all countries, focused on drinking water and sanitation for households based on questions recommended by the World Health Organization[2] and UNICEF to measure access to improved services. The second and complementary battery of questions was administered in 6 of the 18 countries, and focused on service continuity, water bills and prices, perceptions of service quality and experiences with extreme weather events.

The present note summarizes the main results of this effort. The primary message that arises is that the Latin American and the Caribbean region faces a wide range of challenges, that vary both across and within countries. Some areas face the primary challenge of closing access gaps, while others display higher deficiency in service quality, such as continuity. Gaps in service quality, in particular, are not clearly perceived by users. In general, levels of satisfaction with services received are quite high among the population, much higher than warranted by objective measures of service quality. This finding raises important issues for accountability in the sector. If users are mostly satisfied with the current state of affairs, it is unlikely they will pressure governments and utilities to improve service delivery. A more in-depth analysis is required to understand the reasons behind these opinions and possible ways to raise awareness.

Given the magnitude of the data challenges facing the sector, there is a tremendous amount of work ahead to closely track progress toward the SDGs. The data collected in partnership with the LAPOP is just a small step to gain a comparative outlook of access to improved services and some of their quality attributes. The picture is far from complete, but it offers a clear and concise diagnostic of the state of water and sanitation services in Latin America and the Caribbean.

2 World Health Organization and UNICEF. Core questions on drinking water and sanitation for household surveys. World Health Organization, 2006.

Measuring Access to Water and Sanitation Services

The United Nations has fostered growing consensus around the definition of access to water and sanitation services through the Sustainable Development Goals. Targets 6.1 and 6.2[3] offer a comprehensive definition that includes all the desirable attributes of water and sanitation services. The goals reference safety, convenience, equity, behavior, and affordability, as shown in Tables 1 and 2. Such thoroughness, however, comes at a cost when operationalizing and measuring the concepts. Some of these goals can be difficult to quantify, while others require a combination of types and sources of data that are difficult to combine into one indicator.

Target 6.1	Required Data	Possible Sources
By 2030, achieve universal	Type of access for all users: domestic, schools, health centers, workplace, public spaces	Household surveys (HHS), School and health centers Census
and equitable	Type of access for all subgroups in the population (e.g. rural and urban, income level)	HHS, Census
access	Type of access	HHS
to safe	Water tests for pathogens and toxic substances	HHS, Service providers
and affordable drinking water	Prices and income	Service providers, HHS, Census
for all.	Type of access by socio-demographic characteristics (e.g. gender, ethnicity, age)	HHS, Census

Table 1: SDG 6.1 Drinking Water

3 SDG 6.3 covers an important aspect of water and sanitation services regarding wastewater treatment. However, this SDG is not covered in this study since in most cases, the end user does not have information on the quality of wastewater treatment.

To help overcome these challenges, the United Nations Water released concrete recommendations in their publication *Integrated Monitoring Guide for Sustainable Development Goal 6 on Water and Sanitation – Targets and global indicators*, which is updated on a regular basis. For each of the targets in Goal 6, they recommend intermediate indicators and suggest ways to measure them. The intermediate indicators proposed help simplify the tracking task by focusing on a subset of dimensions covered by the original goals (see Table 3). Nevertheless, some challenges persist.

Target 6.2	Required Data	Possible Sources
By 2030, achieve access to adequate	Type of access	Household surveys (HHS), Service providers
and equitable sanitation	Type of access for all subgroups in the population (e.g. rural and urban, income level)	HHS, Census
and hygiene	Hygiene practices (e.g. handwashing with soap)	HHS
for all	Type of access by socio-demographic characteristics (e.g. gender, ethnicity, age)	HHS, Service providers
and end open defecation,	Hygiene practices	HHS
paying special attention to the needs of women and girls	Time allocation and reported needs related to sanitation across gender	HHS
and those in vulnerable situations.	Data from populations that are usually outside the household samples (e.g. detention centers, refugees)	Targeted surveys

Table 2: SDG 6.2 Sanitation and Hygiene

Indicator 6.1.1	Definition
Proportion of population using safely managed drinking water services	Population using an improved drinking water source
	that is located on the premises
	and available when needed,
	and free of fecal and priority chemical contamination

Indicator 6.2.1	Definition
Proportion of population using safely managed sanitation services, including a handwashing facility with soap and water	Population using an improved sanitation facility at the household level
	that is not shared with other households,
	and where excreta are treated and disposed of in situ or transported and treated off-site.
	Presence of handwashing facilities

Table 3: SDG 6 – United Nations Water Recommendations

The bulk of the data required to measure intermediate indicators 6.1.1 and 6.2.1 (presented in Table 3) can be collected through household surveys, as suggested by the WHO and UNICEF[4]. While most countries in the region regularly conduct such surveys with a large sample of the population, the resulting data suffer from three important problems: comparability across countries, representativeness of samples, and lack of data to cover all dimensions of the indicators.

The first issue is conceptual. While most official household surveys in the region include questions about access to water and sanitation services, they do so using different wording and answer categories. This lack of uniformity across surveys prevents comparisons across countries and makes answers often incompatible with the definitions of *improved*[5]

[4] World Health Organization. Core questions on drinking water and sanitation for household surveys. World Health Organization, 2006.
[5] Improved access is defined as "those which, by nature of their design and construction, have the potential to deliver safe water" (JMP, 2020).

access, which is a basic requirement to measure the SDGs and their intermediary indicators. A concrete example refers to the categorization of well water as the main source of drinking water. According to the UN recommendations, a covered well is considered an improved source, while an uncovered one is not. No distinction is made between the two in many countries. Another example is the classification of springs as a primary source of water. Household surveys in Paraguay, for example, assign a specific category to protected springs, considered an improved source. In contrast, household surveys in Colombia and Honduras combine springs with superficial sources of water, such as lakes or rivers; the latter is considered to be an unimproved source of water.

The second problem refers to the representativeness of available data, which is not a problem in most countries. Official household surveys cover large numbers of households across the country, including cities and communities of different sizes, socio-economic characteristics, and geographical locations. However, there are cases like Argentina, where household surveys do not cover rural areas. Instead, rural areas are only included in the census, which is less frequent (every 10 years) and contains fewer questions about WSS. This problem is even more prevalent when collecting information from service providers or governments. In these cases, samples are likely biased, since it is often the higher performing utilities or more developed municipalities that are producing the best and most complete data.

The third and critical issue is the near-total lack of information for indicators beyond the most straightforward and minimum required. Very few official household surveys ask questions about service continuity or take water samples to run water quality tests. In the case of sanitation, it is very rare to find questions about hygiene practices or the handling of individual sanitation solutions, such as types and frequency of maintenance performed on septic tanks or latrines. The lack of information about these aspects of water and sanitation services is problematic because it prevents the sector from having a comprehensive diagnosis of where it

is in the development process and how far it is from achieving the SDGs. Additionally, some of these questions are difficult to ask and prone to social desirability bias from the respondent perspective, making the data less reliable.

These issues prevent us from providing a picture of the state of water and sanitation services in Latin American and the Caribbean that is comparable across countries, nationally representative for each individual country and compatible with the definitions of the SDGs and their intermediate targets. To begin filling this gap and overcome some of these problems, the IDB partnered with the LAPOP in 2018 to collect original data that can offer an initial assessment of the current landscape of water and sanitation services in the region. The goal of this partnership and effort was to present data that is reliable, comparable, representative, and that follow clearly defined and accepted standards within the sector.

The Data

The Latin America Public Opinion Project (LAPOP) from Vanderbilt University conducts face-to-face interviews with a nationally representative sample[6] of the population in most countries in the region on a biennial basis. The data presented in this report were collected between August 2018 and July 2019 in 18 countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, and Uruguay. Table 4 shows the sample size and fieldwork dates per country, as reported by the LAPOP.

The questions used in the interviews cover a range of topics. First, a set of seven questions were added to the LAPOP core questionnaire in all countries, based on WHO and UNICEF guidelines about how to adapt household questionnaires to measure indicators 6.1.1 and 6.2.1. These questions covered the type of water and sanitation service used (whether it was improved or unimproved) and the continuity of the water service. These questions addressed the first three dimensions of indicator 6.1.1 (whether the type of access is improved or unimproved, whether it is located within the premises, and how frequently it is delivered), and the first two dimensions of indicator 6.2.1 (whether the service is improved or unimproved, and whether the facility is shared with other households). In addition to these indicators, the questionnaire also included questions about how households disposed their garbage, and the frequency of their water bill payments. An additional theme in the questionnaire was climate change. Extreme weather events have become increasingly common and can greatly affect service provision. The core questionnaire in all countries contained a battery of questions about respondents' experiences with floods, droughts, and blackouts during the past three years, and who they believe is primarily responsible for such events.

[6] This includes rural and urban population and, in some cases, representativeness at the regional level within countries. Complete information about the sampling strategy and characteristics for each country can be found at the LAPOP website: https://www.vanderbilt.edu/lapop/

Country	Sample Size	Sampling Error	Fieldwork Start Date	Fieldwork End Date
Mexico/Central America				
Mexico	1,580	2.50%	January 30, 2019	March 27, 2019
Guatemala	1,596	2.50%	January 22, 2019	March 20, 2019
El Salvador	1,511	2.50%	November 13, 2018	December 6, 2018
Honduras	1,560	2.50%	October 2, 2018	November 16, 2018
Nicaragua	1,547	2.50%	April 4, 2019	May 4, 2019
Costa Rica	1,501	2.50%	September 24, 2018	October 31, 2018
Panama	1,559	2.50%	October 24, 2018	December 22, 2018
Andean/South America				
Colombia	1,663	2.50%	September 10, 2018	December 27, 2018
Ecuador	1,533	2.50%	January 22, 2019	March 29, 2019
Peru	1,682	2.40%	February 16, 2019	March 25, 2019
Bolivia	1,521	2.50%	March 14, 2019	May 12, 2019
Paraguay	1,515	2.50%	February 13, 2019	April 10, 2019
Chile	1,638	2.50%	January 19, 2019	March 28, 2019
Uruguay	1,581	2.50%	March 8, 2019	May 19, 2019
Brazil	1,498	2.50%	January 29, 2019	March 3, 2019
Argentina	1,528	2.50%	February 16, 2019	April 2, 2019
Caribbean				
Dominican Republic	1,516	2.50%	April 9, 2019	March 3, 2019
Jamaica	1,513	2.50%	February 8, 2019	April 12, 2019

Table 4: LAPOP 2018-2019 Sample and Fieldwork Dates[7]

[7] Additional Information available on: https://www.vanderbilt.edu/lapop/ab2018/AmericasBarometer_2018-19_Technical_Report_W_102919.pdf

Considering the public opinion aspect that characterizes LAPOP, an additional set of questions was asked to respondents in six countries (Bolivia, Brazil, Chile, Ecuador, Panama, and Uruguay). These questions focused on respondents' perceptions and attitudes toward water services. When respondents reported not being connected to a water or sanitation network, they were asked the reasons why that was the case. Some additional items focused on perceptions of service quality – water pressure, taste, and cleanliness – while others focused on pricing – water bill amount and opinion about price levels. Lastly, respondents were also asked about whether they had access to meters to track usage and what water-saving practices were commonly adopted, if any. This two-part questionnaire approach explains why some of the figures presented in this report include all 18 countries, while others only include six.

In a validation exercise, Datshkovsky and Machado (forthcoming) compared the sample features and estimates obtained from the LAPOP data with those obtained from official household survey data for all countries and questions where the wording of questions and their answer categories permitted comparison. Based on the results obtained by the authors, some qualifications apply to the estimates presented in this report. The most important caveat refers to the sample size and its characteristics. Specifically, LAPOP samples are designed to be representative of the national population, both urban and rural. Given that Latin America is a highly urbanized region, sample sizes for rural areas are small and remote areas have a very small probability of being included. Additionally, LAPOP samples in several countries in the 2018/2019 wave included respondents with higher than average educational attainment when compared to official household surveys. Given the positive correlation between educational attainment and access to better services (piped and inside the home) (Basani, Isham, & Reilly, 2008; Larson, Minten, & Razafindralambo, 2006), the estimates displayed in this report should be taken as an upper boundary of access rates and quality of service.

Water and Sanitation in Latin America and the Caribbean

Water

Access to improved water services – defined as those coming from a protected spring or well, tube well, public standpipe, rainwater, or piped water – is rather high in the region. But as standards increase, such as requiring that the source be located close to the home or inside of it, coverage rates drop significantly in some cases (see Figures 1 and 2). This is particularly visible when we consider the nested nature of the categories presented in Figures 1 and 2. For example, the share of responses to the "Improved" category incorporates "Piped to dwelling" (which also includes "Piped to house") and additional non-piped protected sources. Similarly, "Piped to dwelling" incorporates "Piped to house" as part of the calculated share of responses. The drop in coverage rates illustrates the magnitude of the challenge to many countries that the shift from the Millennium Development Goals (MDG) to the Sustainable Development Goals represents. From the more lenient definition of *improved* services in the MDGs, the SDGs have raised the bar considerably to include requirements of *proximity, continuity, and quality* of the access reported.

The implications of these additional requirements in measuring and tracking progress are significant. For example, the share of the population with access to improved services in urban areas is, in most cases, around 90% or higher. But when it comes to access to water piped to dwelling (meaning that consumers receive water to their premises, but not necessarily inside the house), shares can drop to as low as 72%, and even lower if considering piped services inside the house. Similar trends, but at considerably lower levels, are observed in rural areas, as shown in Figure 2.

A second important implication of the move from MDGs to SDGs is that the SDGs include multiple dimensions of service provision, not just type of access. This means that countries with the same overall indicator could be facing very different challenges in meeting the goal. While some countries might need to close the access gap, others might need to focus their efforts on improving service continuity or the quality of water delivered. It is, therefore, important to consider each of the dimensions in indicator 6.1.1 separately. Improving access requires different policies and interventions than improving continuity or the quality of the water. Any diagnosis of the state of water and sanitation services that overlooks these differences is incomplete.

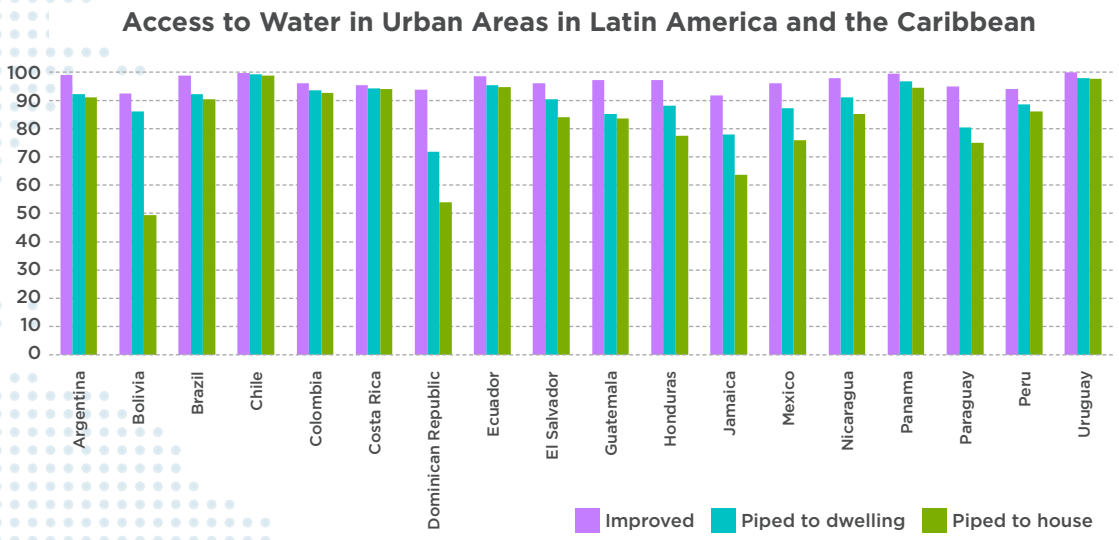

Figure 1: Access to Water Services (Urban)
Note: Bars show the estimated percentage of the urban population whose water access falls into each of three categories: improved (see definition in (cite WHO UNICEF)), piped water to dwelling, and piped water inside the house.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave and 2018 Bolivian Household Survey. Methodological details included in Appendix A.

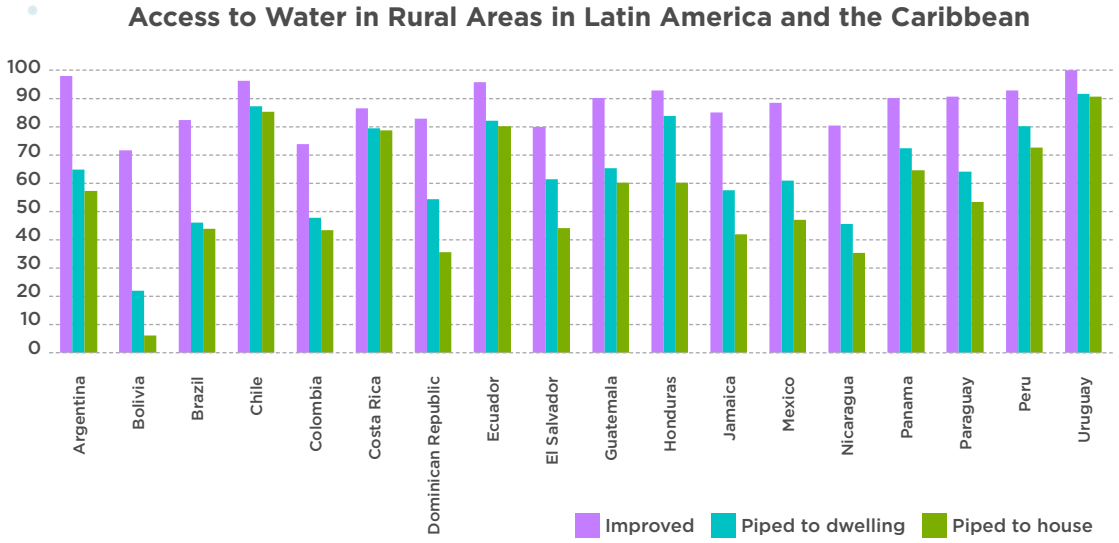

Figure 2: Access to Water Services (Rural)
Note: Bars show the estimated percentage of the rural population whose water access falls into each of three categories: improved (see definition in (cite WHO UNICEF)), piped water to dwelling, and piped water inside the house. For original questions and coding rules, see the appendix.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave and 2018 Bolivian Household Survey. Methodological details included in Appendix A.

Before moving on to the other service dimensions, it is important to note that closing the access gap requires understanding the reasons behind it. One of these reasons is what is known as "the last mile problem" (Blume et al, 2015; Sturzenegger, Vidal & Martinez, forthcoming), where even though the service is offered to users, they do not connect. Respondents who reported no connection to a piped service were asked precisely that question: Why are you not connected?

The most common (and spontaneous) answer was that the network did not reach the respondents' homes or that there was no interest from authorities and water providers to provide the service to them. Alternatively, many stated a preference for their existing type of service or conveyed that their current solution was the most popular in their neighborhood. Very few respondents mentioned the costs to connect or the service fees as the reason for not connecting. Figure 3 presents the distribution of responses in two parts. In the top panel, the columns represent the share of respondents in each country who reported not being connected to the service network. On the bottom panel, three categories group the main reasons for not being connected: "Cost" (either cost of connection or service fees), "Prefers current system", and "No service available" ("There is no coverage in this area", "Authorities are not interested in providing the service"). From the perspective of governments and policymakers in the sector, these answers suggest that they would need to rely primarily on the construction of new infrastructure to increase the number of households connected to piped services. An alternative possible interpretation of these results is that households are unaware of a network being available to them. In this case, informational campaigns could help raise the number of connections.

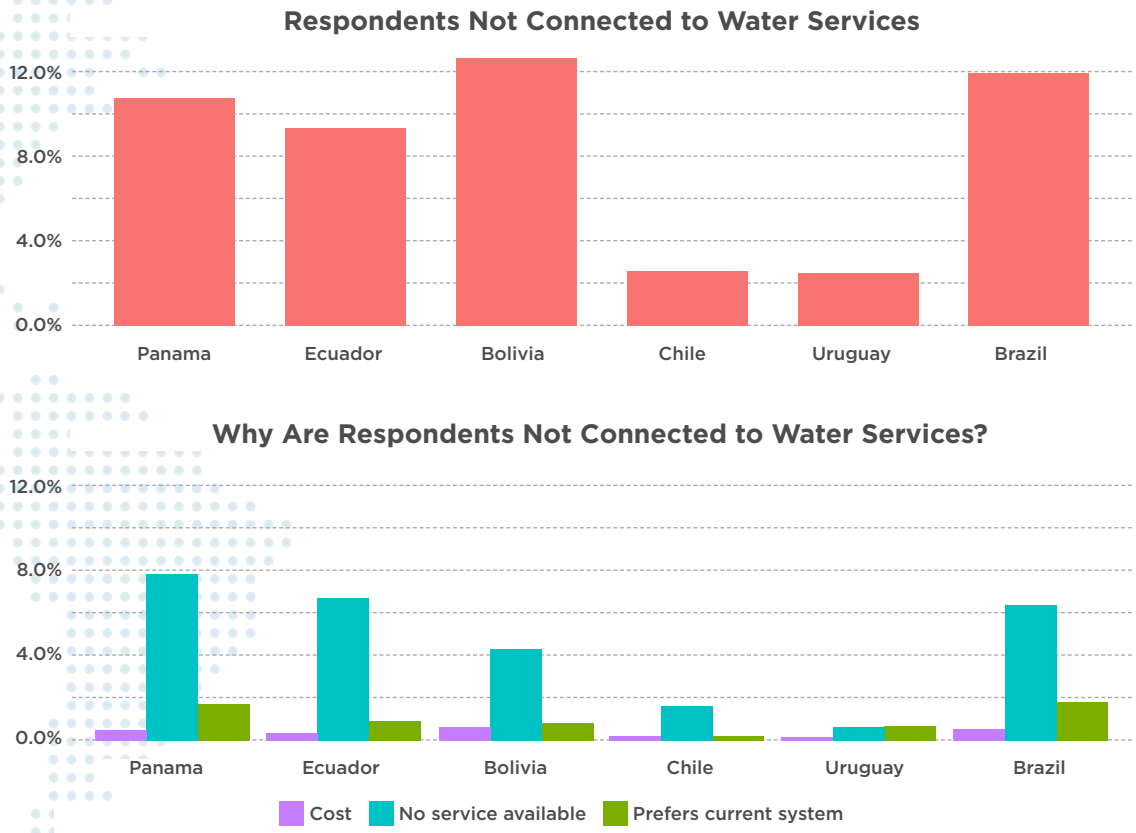

Figure 3: Respondents Not Connected to Water Services and Why
Note: The top panel displays the percentage of respondents who reported no access to piped water services. The bottom panel shows the percentages of respondents who mentioned the costs of connection and service provision, the lack of a piped network in their area, or a preference for their current method of water provision as a reason for not being connected to the piped network.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

The next element in the definition of SDG target 6.1.1 refers to service continuity. Its definition stipulates that water should be "available when needed". This dimension can be measured in different ways and likely means different frequency of service to different people. In this study, continuity is measured based on days per week and hours per day of regular service. All respondents reporting access to piped services were asked about the number of days a week they received regular service, and the number of hours per day. Additionally, they were asked if they had experienced interruptions to their regular service in the last month. The picture that emerges is one of great diversity across the region. Figures 4 through 7 help illustrate this point.

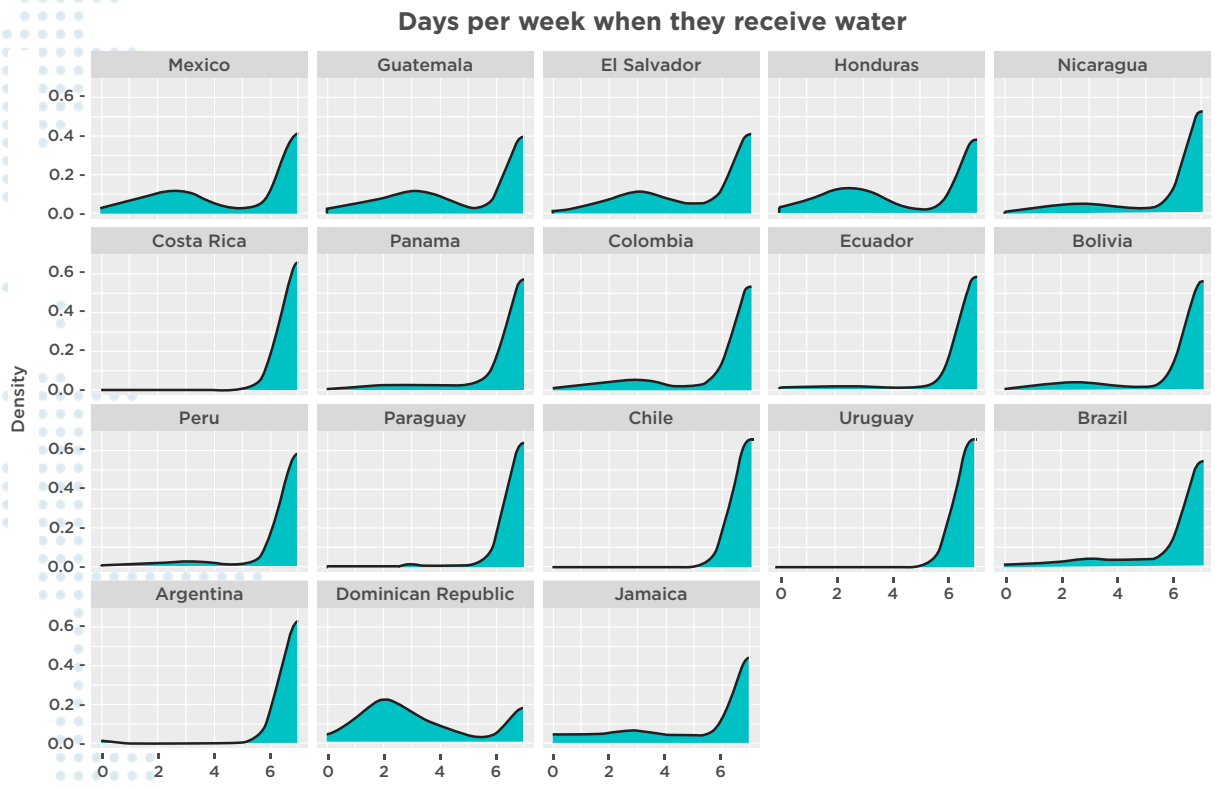

Figure 4: Days per Week of Access to Water Services
Note: Graph displays the density distribution of answers to the question: "How many days a week do you receive your regular water service?"
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

As shown in Figure 4, most people surveyed have access to water every day of the week. However, in many countries of the region, there is a sizeable proportion of the population (around or below 20%) that reports receiving water between two and four days a week. The left tails of the distribution in the graphs represent the gaps that need to be closed, if the goal is for the population to have access to water services seven days a week.

Receiving water most days of the week might not guarantee that water is available when needed. It would depend on how many hours a day service is available and how convenient these hours are. In general, most respondents reported receiving water close to 24 hours on the days they receive their regular service, as Figure 5 shows. But in some cases, there is a significant

share of individuals reporting less than 12 hours of service, as can be seen in the accumulation of responses in the lower tail of the distributions for countries like Peru, Nicaragua, Guatemala, Dominican Republic, Mexico, El Salvador and Honduras.

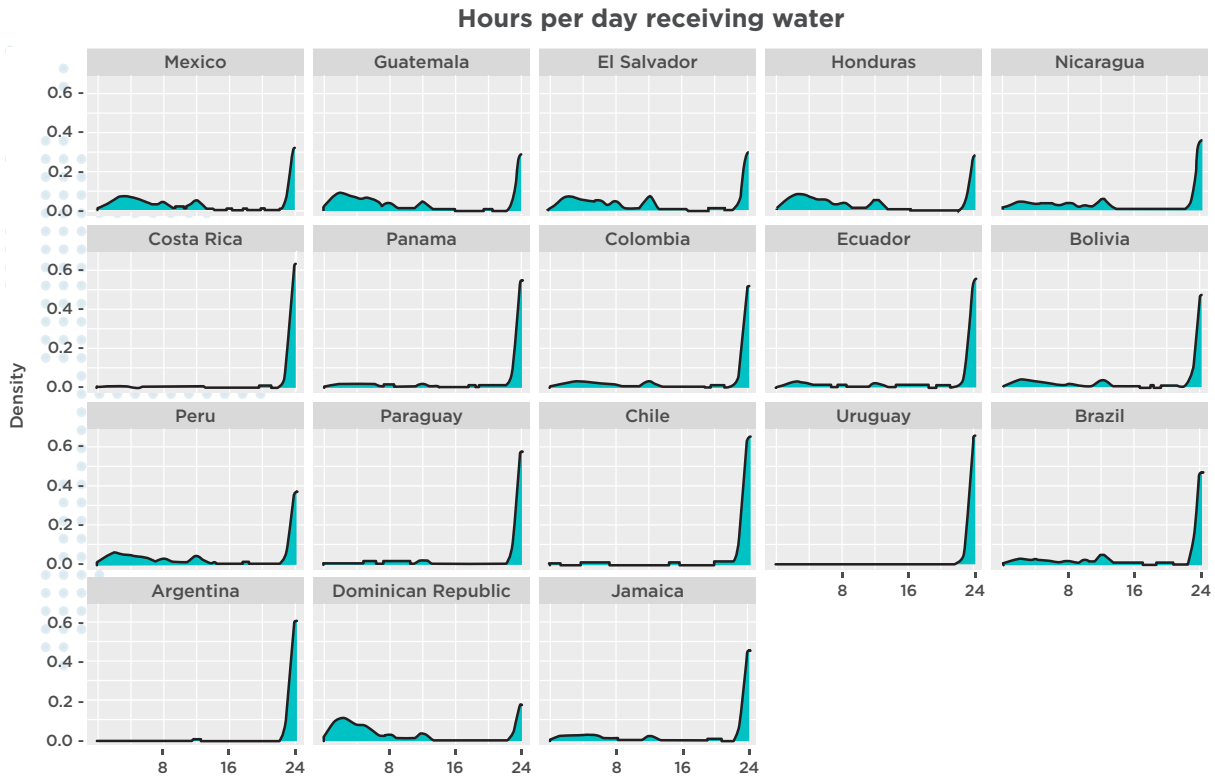

Figure 5: Hours per day with Access to Water Services
Note: Graph displays the density distribution of answers to the question: "How many hours of water per day do you get during the days you have service?"
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

While taken independently, both measures of continuity show high levels of service availability, the picture changes significantly when the two measures are combined. While in countries like Uruguay and Chile, almost all the population fall into this category (receiving water service 24 hours per day, 7 days a week), in five of these countries, less than half the population enjoys the same continuity of service. Again, this very uneven picture suggests important gaps in continuity that need to be filled in the region.

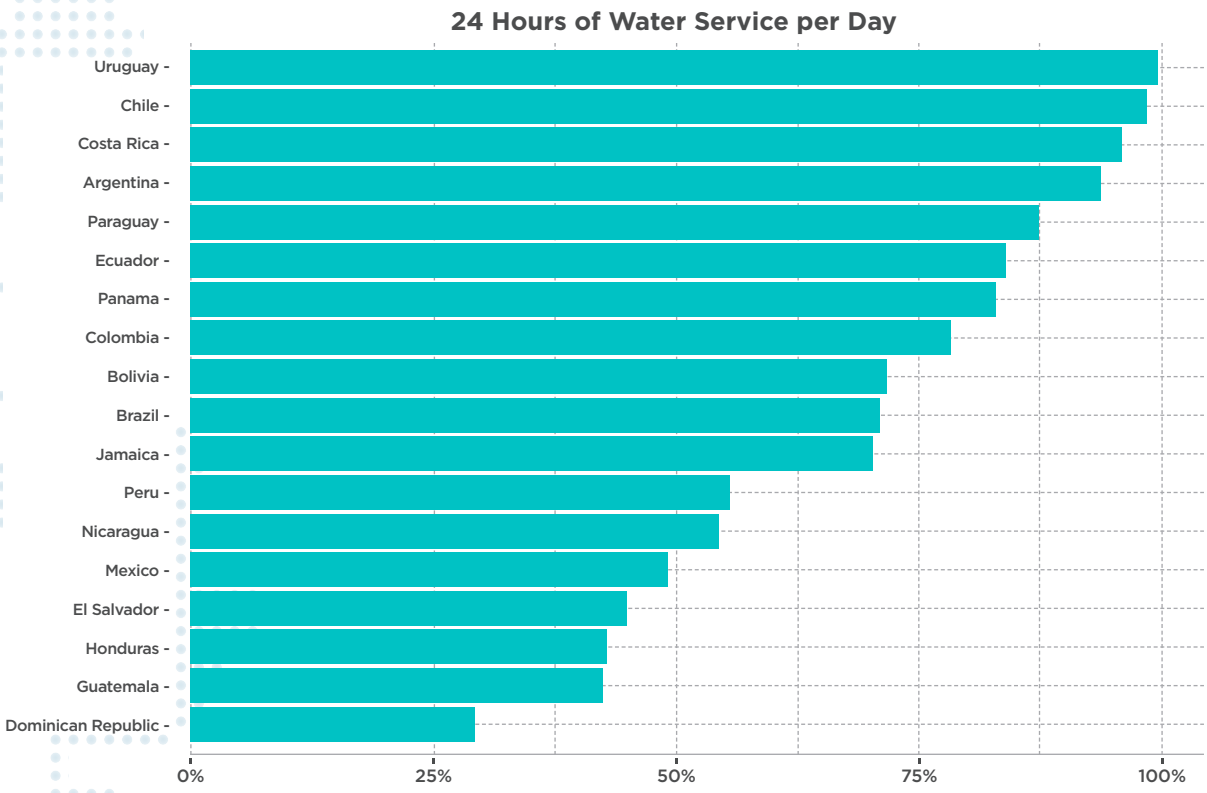

Figure 6: 24 Hours of Water Service per Day
Note: Bars represent the estimated percentage of the population that reports receiving water service 24 hours a day, 7 days a week.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

The number of days per week and hours per day of regular service still do not present a complete picture of service continuity. In many cases, households in the region need to contend with additional interruptions to the ones experienced on a regular basis. When asked about the number of such interruptions during the past four weeks, the average number reported per country varies from less than one (in Chile) to over five in that same period (in Jamaica). This variation can be the result of structural problems, but also external events, such as extreme weather.

In addition to providing information about continuity, these results also raise concerns about water quality from two main sources. First, interruptions may be caused by breakages in the pipe system, which can allow contamination to seep into the treated water being distributed. The

second concern related to water quality involves the common practice of households storing water in tanks as a means of coping with interruptions. If tanks are not protected properly and washed regularly, however, there is a risk of contamination (Shaheed et al., 2014a; Shaheed et al., 2014b). More data and analysis are necessary to understand the full implication of these results.

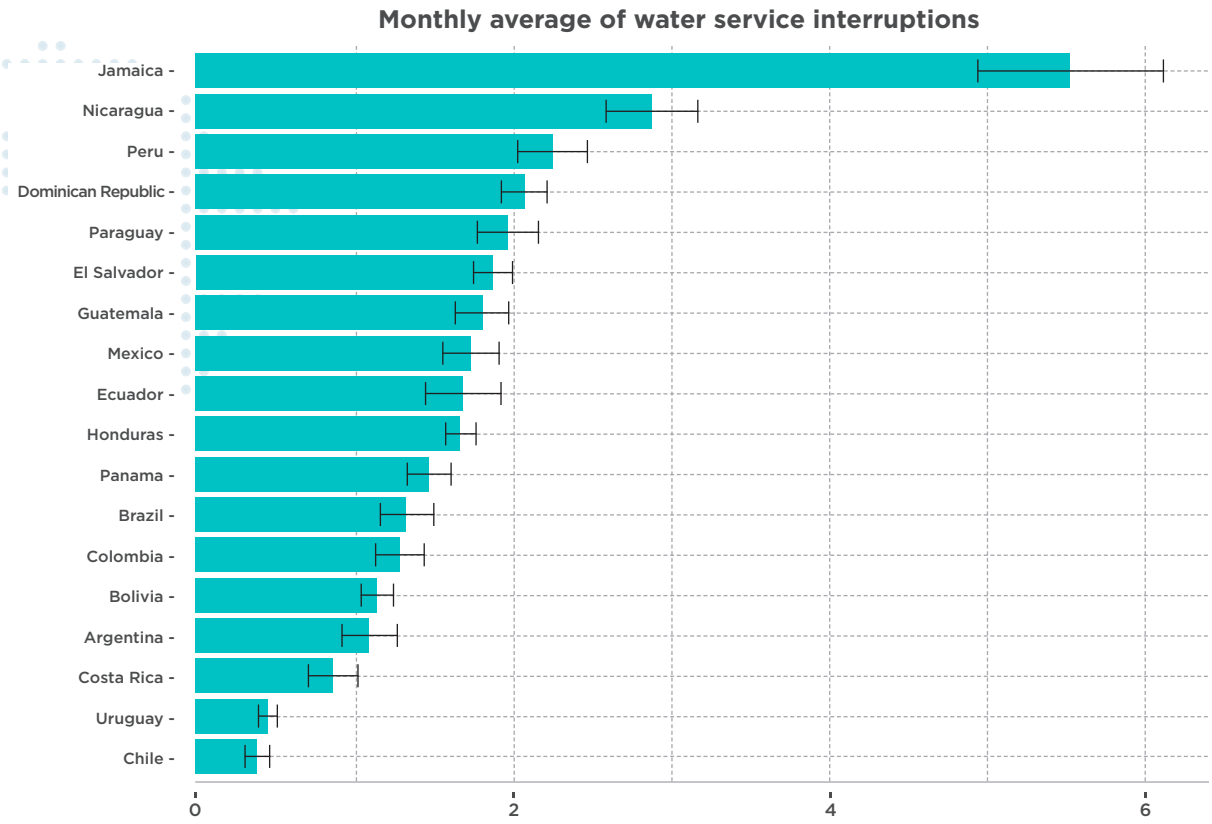

Figure 7: Monthly Average Interruptions of Water Service
Note: Bars represent the estimated average number of interruptions to regular services, based on respondents' answers to the question, "During the past four weeks, how many times has the regular water service been interrupted?". The lines represent 95% confidence intervals.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

A less studied aspect of service continuity is water pressure. If pressure is low, it can impact available quantities and possible uses of water. To measure this aspect, respondents in six countries were asked to rate the quality of the water pressure coming from their piped services. Figure 8 shows the results. The majority of those with access to a piped service in the six countries reported that water pressure is "good" or "very good". In half of these countries, however, about one-third of piped service customers rated the pressure from "regular" to "very bad". Considering that users tend to rate the service quality above the levels expected, given objective measures of quality (Gomez Vidal, Cabezas Navarro, Machado, & Datshkovsky, n.d.), this result can be taken as a lower bound.

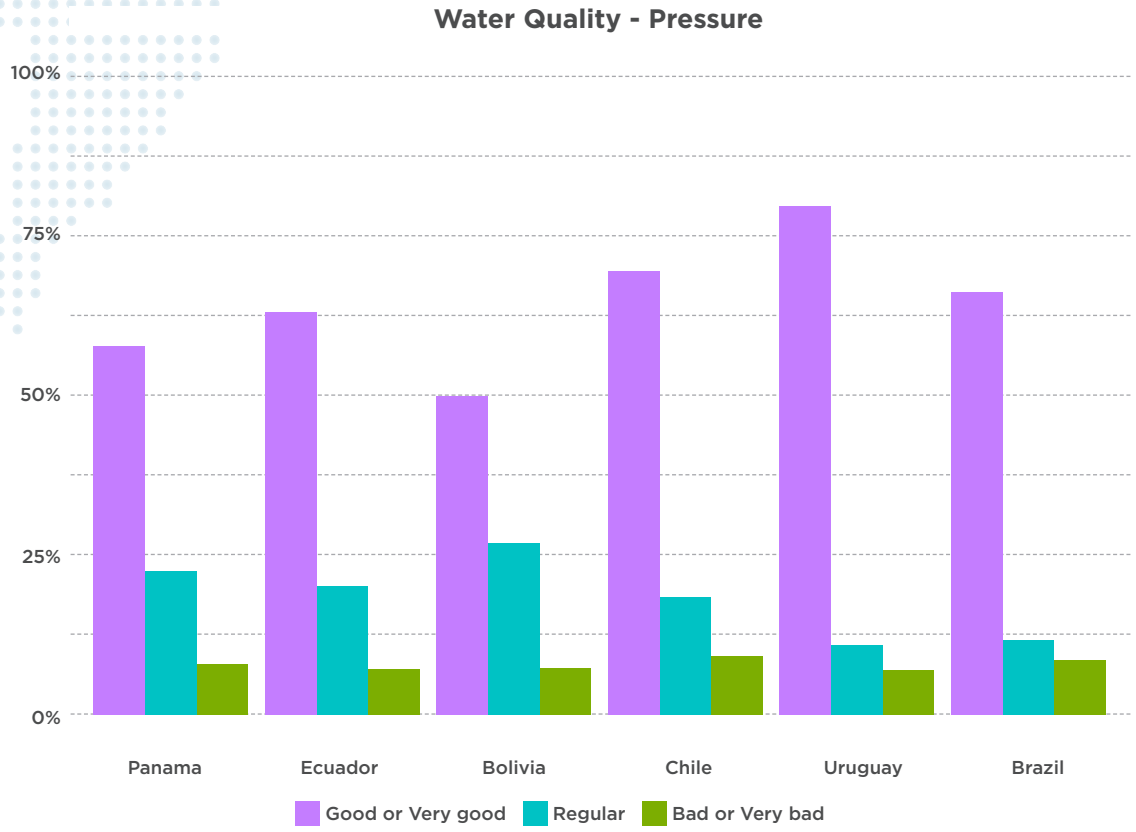

Figure 8: Quality of Water – Pressure
Note: Bars represent the estimated percentage of the population in each country that rates the pressure of the water they receive through a pipe network as either "good or very good", "regular", or "bad or very bad". These estimates were calculated based on the question "How would you rate the quality of each of the following aspects of your water service? The water pressure in your home. Would you say that it is... Very good, good, regular, bad, very bad."
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

The last dimension relevant to measuring target 6.1.1 refers to the quality of water provided, specifically, to the absence of contaminants. While no water quality tests were performed as part of this project, respondents were asked about their perceptions of water quality in terms of taste and cleanliness. The general perception is that both are good. Figures 9 and 10 present the results. On average, the ratings for these two categories are lower than those for water pressure. In the case of water cleanliness, in all countries except Bolivia, over half of respondents reported cleanliness being "good" or "very good". The share of households that reported "regular" to "very bad" cleanliness, surpasses 30% in all cases. Results are even more dispersed when it comes to water taste. In that case, as displayed in Figure 10, Chile, Bolivia and Uruguay have no more than 50% of the sample say that this feature was "good" or "very good", and almost one-fourth of respondents in Uruguay and Chile reported taste being "bad" or "very bad".

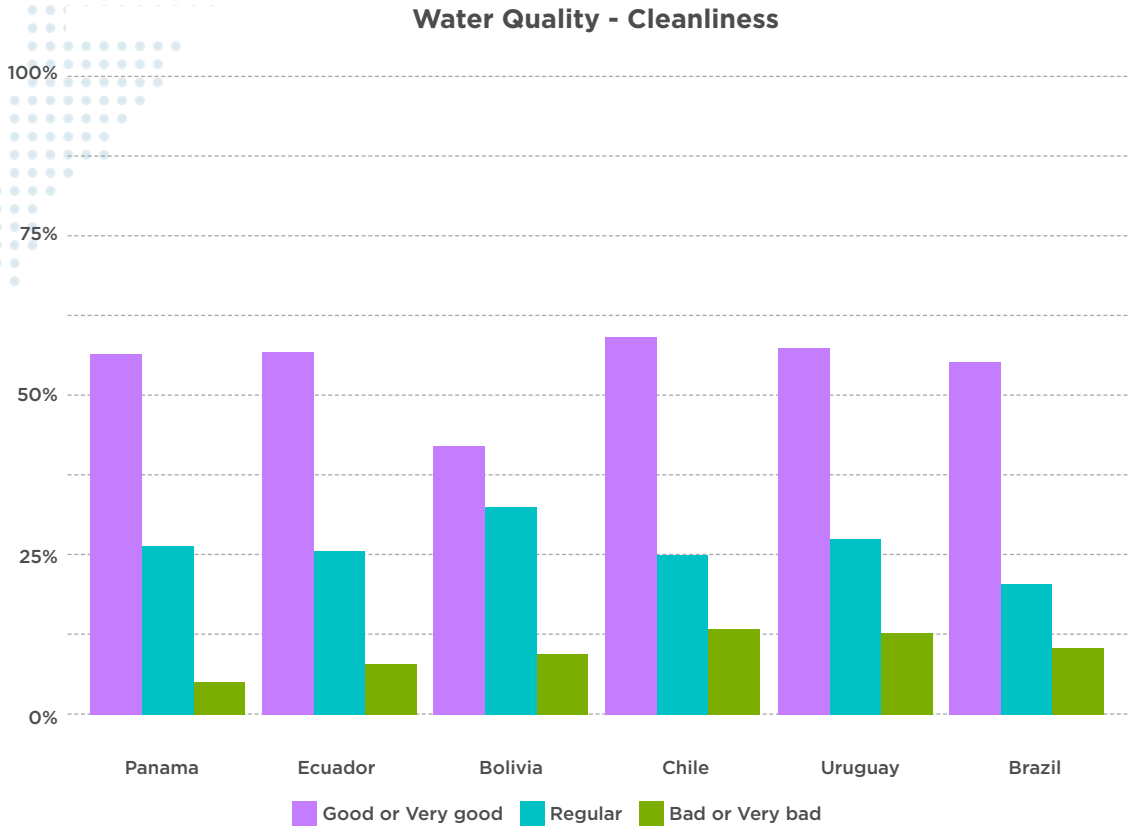

Figure 9: Quality of Water - Cleanliness
Note: Bars represent the estimated percentage of the population in each country that rates the cleanliness of the water they receive through a pipe network as either "good or very good", "regular", or "bad or very bad". These estimates were calculated based on the question, "How would you rate the quality of each of the following aspects of your water service? Cleanliness of the water. Would you say that it is... Very good, good, regular, bad, very bad."
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

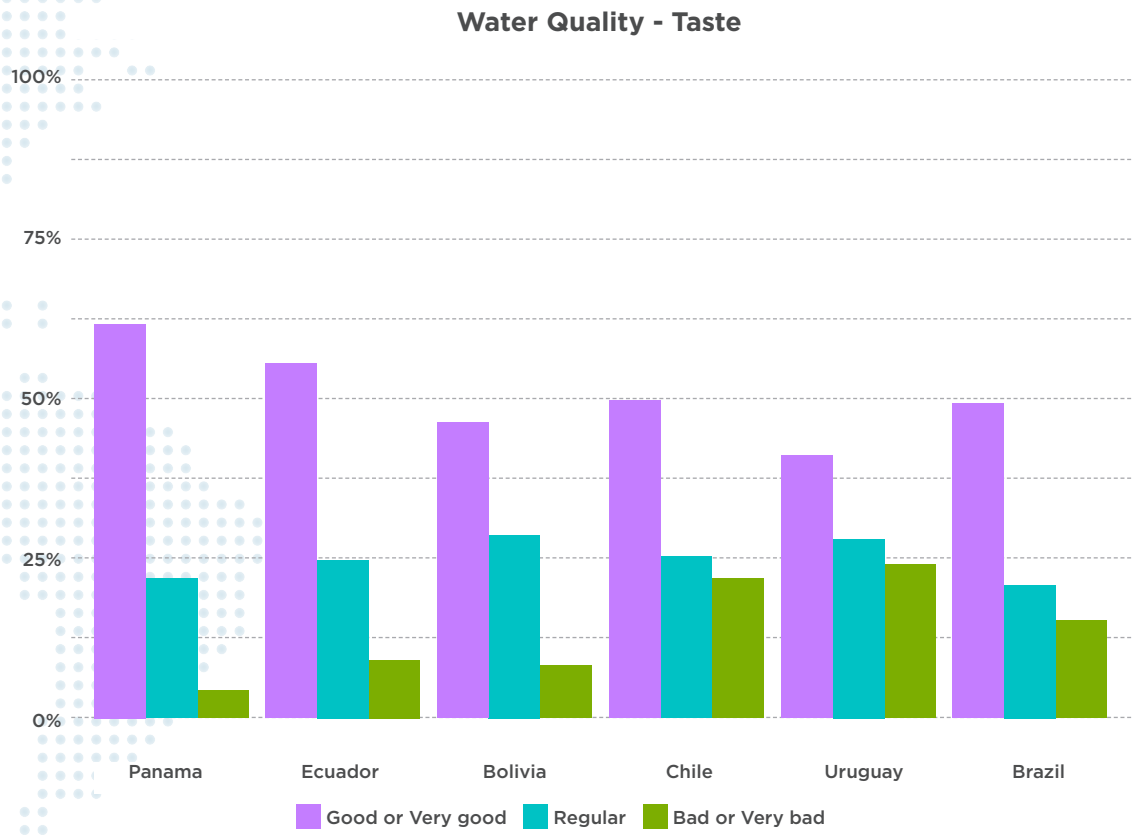

Figure 10: Quality of Water - Taste
Note: Bars represent the estimated percentage of the population in each country that rates the taste of the water they receive through a pipe network as either "good or very good", "regular", or "bad or very bad". These estimates were calculated based on the question, "How would you rate the quality of each of the following aspects of your water service? Taste of the water. Would you say that it is... Very good, good, regular, bad, very bad."
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

Guaranteeing high water quality, particularly in terms of its safety for consumption, is essential for achieving SDG 6. However, water quality in and of itself does not always suffice to reassure consumers about the safety of piped water for different uses. Even if water quality ratings are generally good, a non-negligible share of respondents chooses to use bottled water for multiple purposes (that is, other uses besides drinking). Figure 11 displays these results.

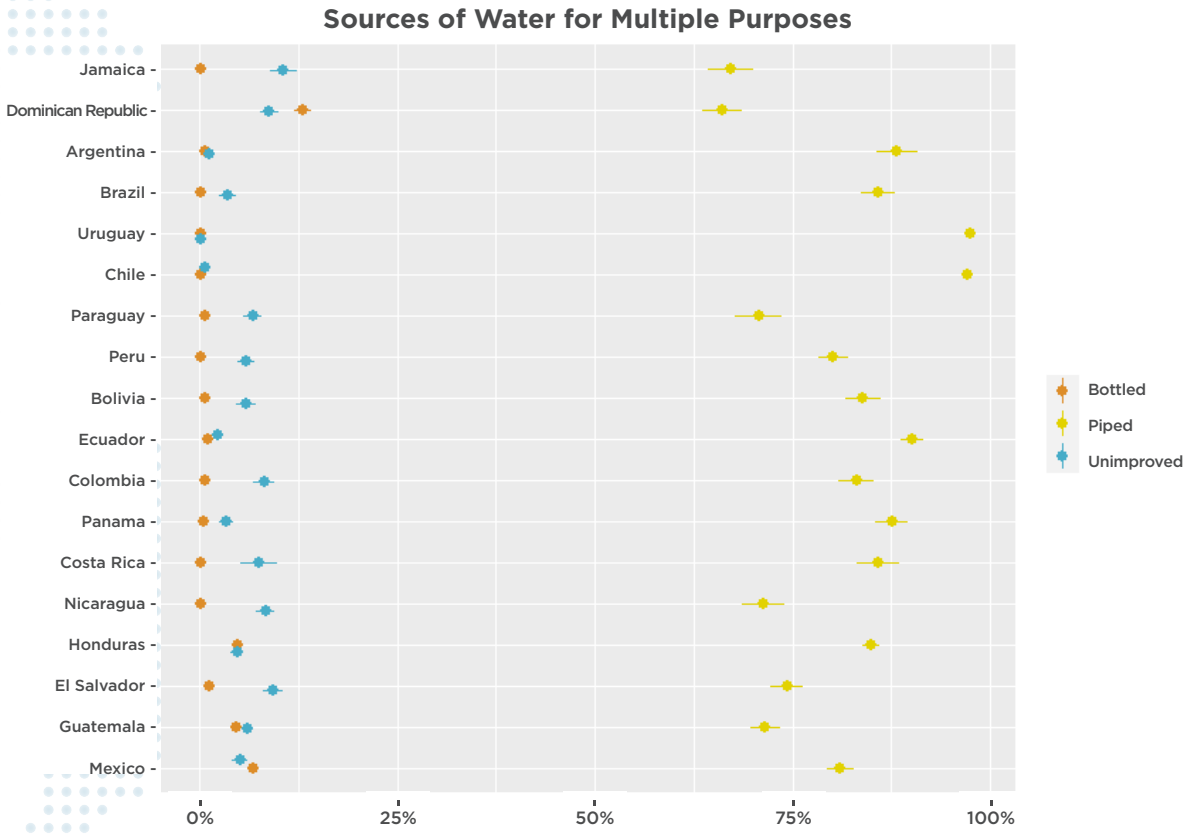

Figure 11: Sources of Water for Multiple Purposes
Note: Dots represent the estimated percentage of the population using each of the sources of water for purposes other than drinking. The lines represent the margin of error for the estimates.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

An even more interesting result comes from comparing the share of respondents who report having access to piped water and who use bottled water for drinking purposes. As Figure 12 shows, in all countries except Dominican Republic, the percentage of people drinking bottled water is even higher than the share of respondents with access to piped water. Yet the differences are narrower than one would expect for respondents who consider the quality of their piped water as good or very good. For example, in Mexico, the share of respondents who report using bottled water for drinking is almost the same as the share of respondents who have access to piped water. The variation across countries also shows how the relationship between having access to water and drinking out of the tap is not straightforward, despite the high quality attributed to piped water among respondents in our sample.

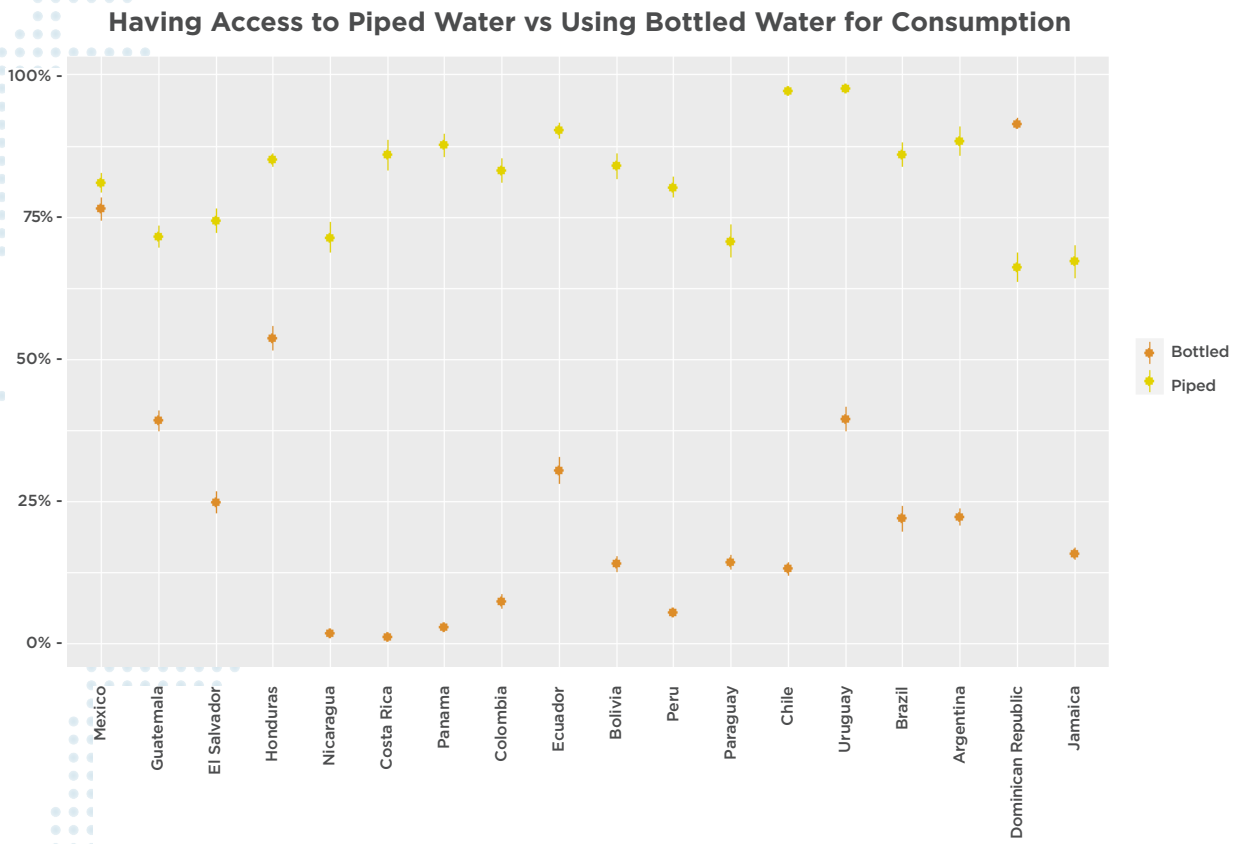

Figure 12: Having Access to Piped Water vs Using Bottled Water for Consumption
Note: Dots represent the estimated percentage of the population having access to piped water and the percentage of the population drinking bottled water. The lines represent the margin of error for the estimates.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

Price is an important aspect of access to water generally, and water services specifically. This is a key factor where an important balance needs to be struck. Prices charged need to be enough to cover costs of service provision in order to ensure the financial sustainability of water utilities. At the same time, prices need to be set at levels that ensure no one is denied access to this basic service due to financial constraints. In other words, there is a constant trade-off between making the service affordable to all and recovering costs. The service can be very costly to provide depending on local conditions, including resource availability, topography and urban planning. It is not clear, however, whether individuals are aware of such conditions and their associated costs.

Before trying to gauge respondents' perceptions about the price they pay for services, they were asked about their service bill amount. The results

are revealing. Across the region, respondents reported numbers that varied considerably, even among customers of the same utility. Figure 13 shows the distribution of some of these answers, transformed to U.S. dollars based on the exchange rate for the national currency at the time the interviews were done. There was a significant number of responses across countries that estimated these bill amounts as high as US$200, a clear outlier from the rest of the distribution. For a more informative visualization of the distributions, Figure 13 only includes responses up to US$75. The discrepancies in bill reporting is hard to explain based on tariffs, location or household size alone. In many cases, it could simply reflect a random guess about the actual bill amounts.

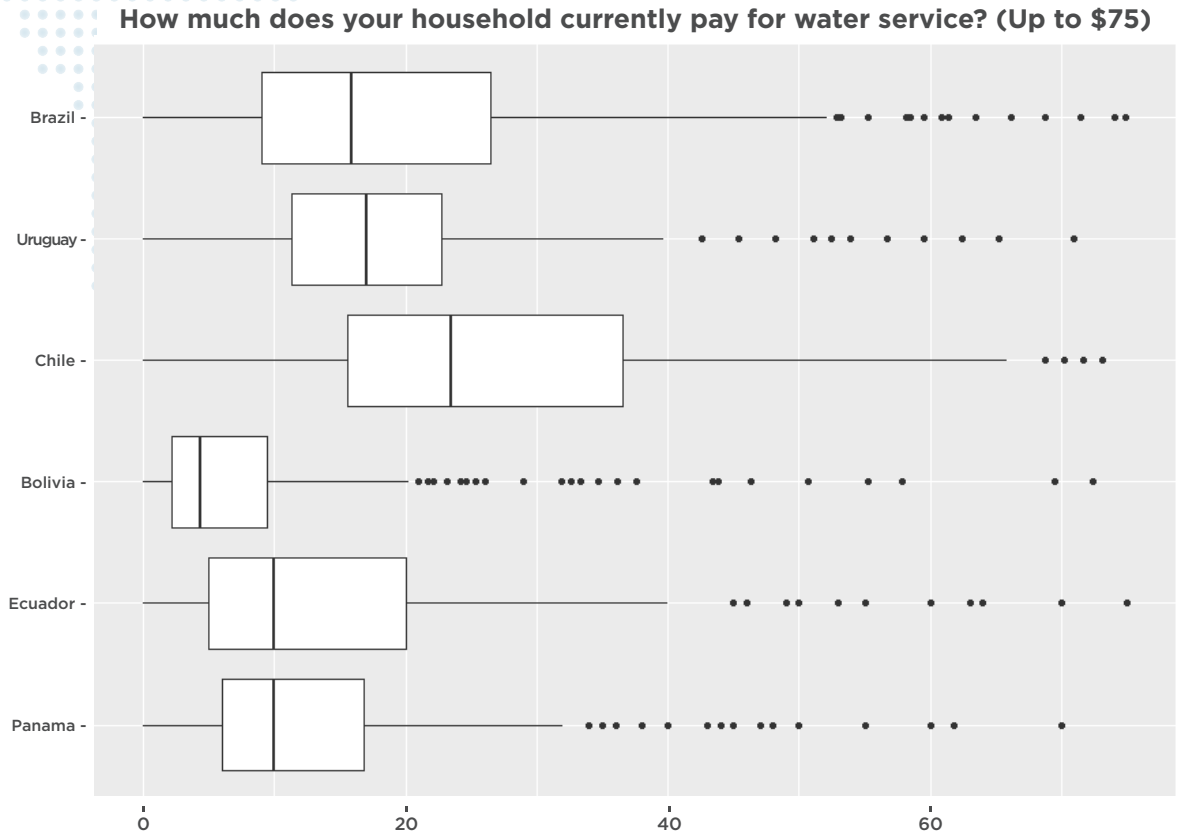

Figure 13: How Much Do You Currently Pay for Your Monthly Household Consumption? (Up to US$75)

Note: The box plots display the distribution of reported bill amount based on answers to the question: "How much do you currently pay for your family's water consumption in one month?". Thick lines correspond to the median value, the box represents the range between the 25th and the 75th percentile of the distribution, and dots represent outliers. Amounts are expressed in US dollars, using the exchange rate of the interview date.

Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

One way of assessing the potential magnitude of the affordability problem in the region, is to estimate delinquency in bill payment. Respondents were asked how many bills they had not paid out of the last six received. Figure 14 shows the distribution of responses. Self-reported delinquency in bill payment for the past six bills received was in the 10%-15% range in most countries. The lowest delinquency rates were reported in Costa Rica (about 4.5%) and the highest in Ecuador (17%). In most cases, most unpaid bills reported were clustered around one and two unpaid bills out of the last six. These could be taken as a lower bound estimate, given that not every respondent feels comfortable reporting this type of information.

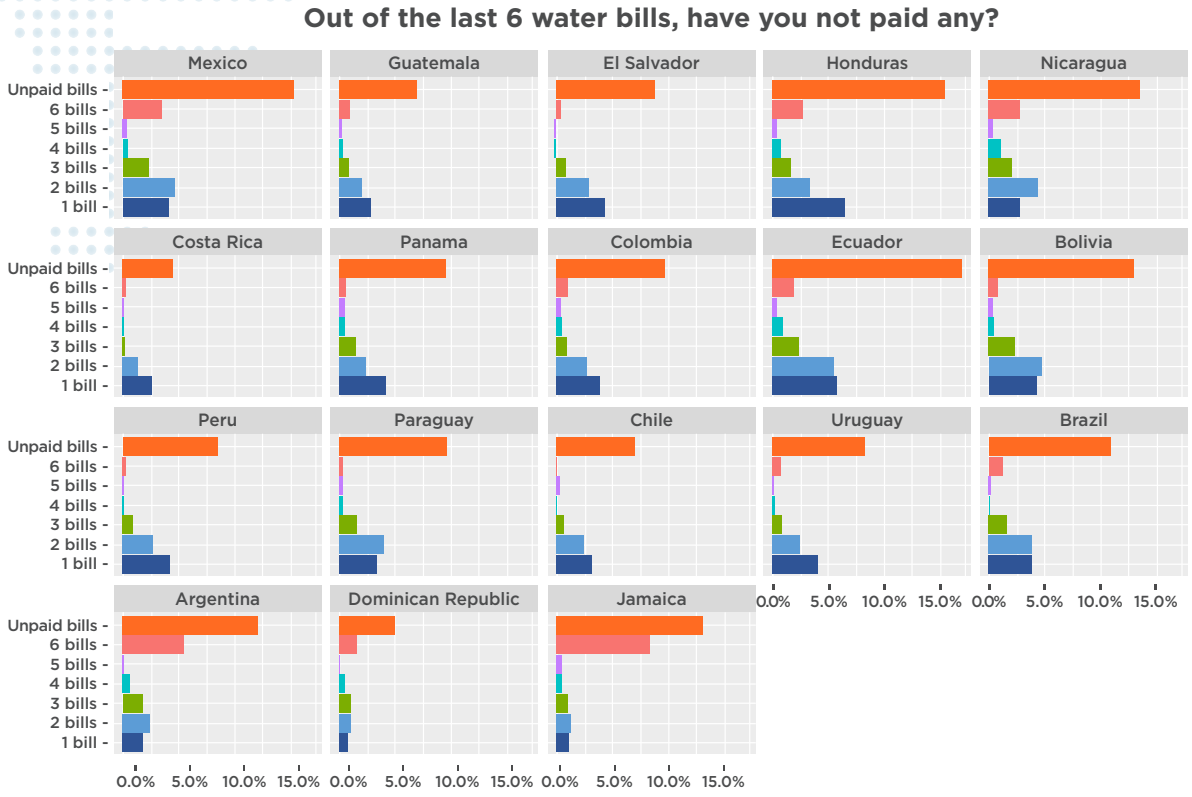

Figure 14: Out of the Last 6 Bills, Have You Not Paid Any?
Note: The bars in each graph represent the share of that number of unpaid bills reported per country. Category "unpaid bills" represents the share of all unpaid bills reported per country. For visualization purposes, categories 0 ("No") and 7 ("Did not pay because did not receive the bill") were omitted.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

Once respondents provided information about their bill amounts and frequency of payment, they were asked for their opinion about the service price. In six countries they were asked whether the price they pay for their water service should remain the same, be lower, or be higher than the current amount. As shown in Figure 15, the prevailing view was that prices should either be lower or the same as they currently are. While these responses are not surprising, they help paint a broader picture about the tension between costs of provision and affordability and bill payment. Respondents are rarely willing to pay more for service. But they also lack of information about the cost of service provision and the gap with prices currently paid by them. This imperfect information about services could be a potential culprit for misaligned incentives between providers and consumers.

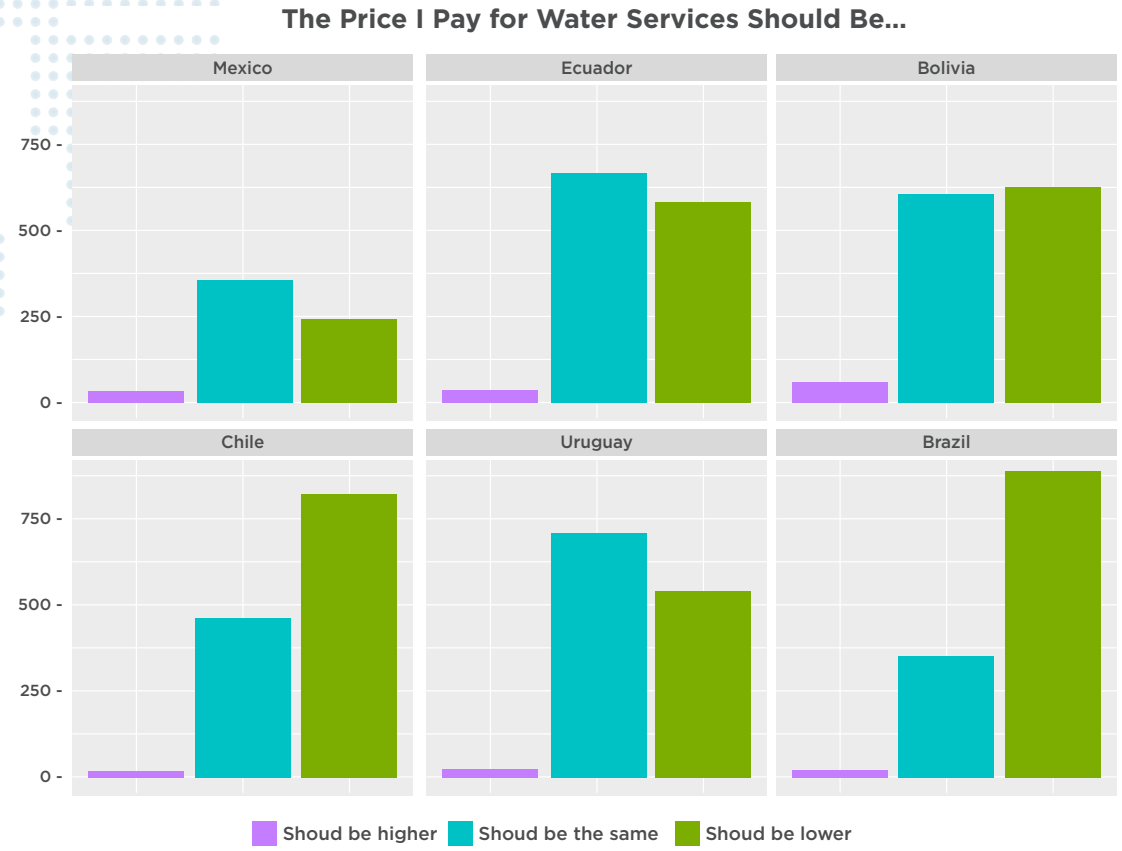

Figure 15: The Price I Pay for Water Services Should Be...
Note: The bars in each graph represent the share of responses for each option to the question, "Thinking about how much your household pays for water, which of the following statements reflect your opinion?" per country.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

The picture painted so far would not be complete without exploring consumers' behavior and awareness about their water consumption. To do so, respondents were asked two more questions. First, respondents were asked whether they had meters in their house that informed how much water they consume. Figure 16 shows that a majority of respondents in almost all countries surveyed reported having individual meters. In Panama, however, the share of respondents reporting access to individual meters is almost the same as the share who do not have meters at all, making it hard for individuals to monitor their own water consumption. It is, however, often the case that the installation of meters is not the consumer's responsibility but a decision of water providers.

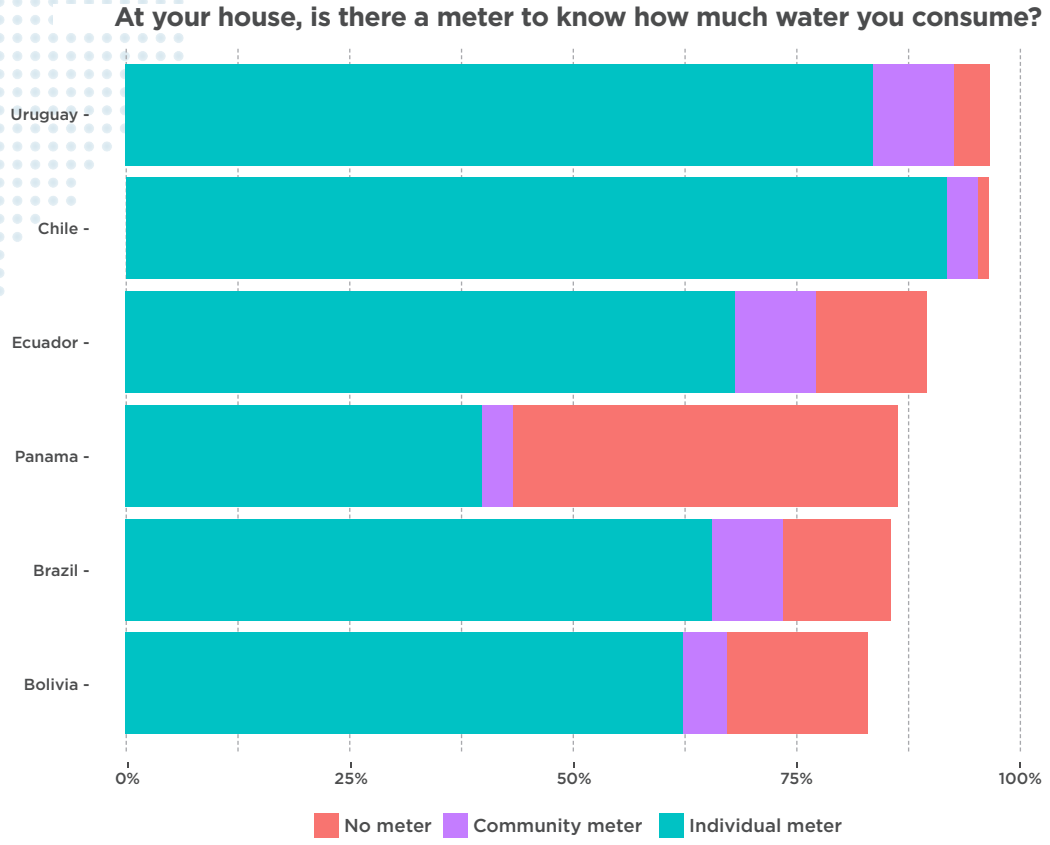

Figure 16: Is There a Meter?
Note: The bars in the graph represent the share of responses for each option to the question, "Is there a meter in your household to know how much water you consume?" per country.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

Having an individual meter can not only help consumers monitor their water use, but, in some cases, also provide incentives to save water. To explore these relationships, the questionnaire also included a question about water-saving strategies adopted by the household. Respondents were asked whether they, or any member of their family, adopted any item(s) identified on a list of actions and devices intended to reduce water use. Figure 17 shows the distribution of these results for five of the countries in the sample. Looking only at whether respondents report following at least one strategy, the range of responses is between 47% (Chile) and 79% (Brazil). Despite the wide range of answers across countries, reducing the use of water in personal hygiene (showering, brushing teeth, and so on) was the most popular strategy reported in most countries. "Other measures" not listed in the questionnaire and not specified by respondents were the second most common answer. Interestingly, strategies related to household work and cleaning are relatively low in popularity in the sample.

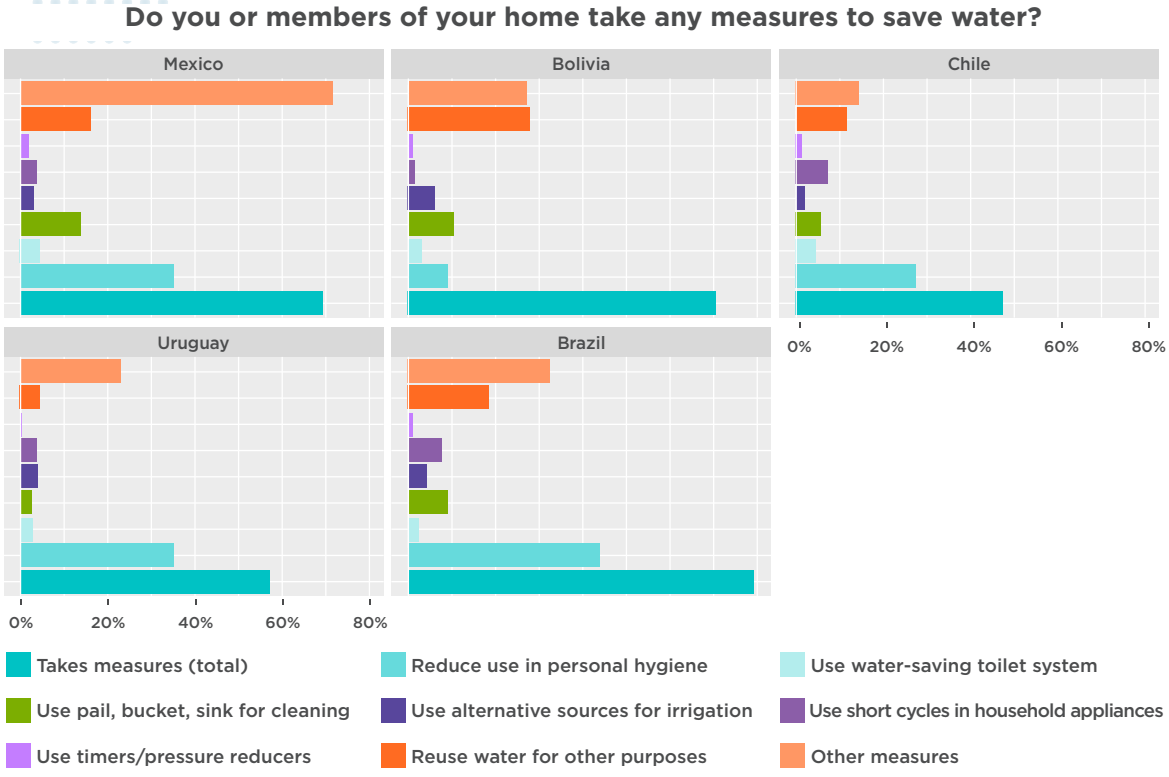

Figure 17: Do You or Members of Your Home Take Any Measures to Save Water?
Note: The bars in the graph represent the share of responses for each option to the question, "Do you or members of your household take any measures for saving water?" per country. The lowest bar in each graph, "Takes measures (total)" represents the total share of positive responses per country.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

Overall, the results presented in this subsection suggest that consumers do not always have a clear idea about how much they pay for their water service, and that in general, they would rather not pay more for it. Self-reported delinquency rates are non-negligible, at around 10%-15%. Moreover, a sizeable proportion of respondents are not able to monitor their water use through individual meters or may not be aware of one being available to them. Variation across water-saving habits suggests their implementation is scattered as well.

This section explored various dimensions of water services that are part of the SDG indicator 6.1.1 on water, as well as some attitudes and perceptions about prices and water use from the population. The present analysis shows that challenges associated with SDG 6 vary significantly across and within countries. While some countries need to increase access to sources closer to homes, others need to work on improving service continuity. What is consistently true across countries is that more efforts are needed to track water quality, an important dimension for which very little data is available. The breakdown of these different dimensions to target 6.1.1 makes it clear that relying primarily on average scores for all dimensions of Goal 6 hides critical information about very distinct and disparate scenarios across Latin America and the Caribbean. Consequently, policies to move toward achieving SDG 6 might look very different across countries, depending on what and how its dimensions play out in each case.

Measuring Access to Sanitation

Similar to the case of water services, access to sanitation varies considerably depending on how it is measured. Access to "improved" sanitation services, defined as "those designed to hygienically separate excreta from human contact" (JMP 2017, p. 8), is significantly lower than access to improved water, but relatively high compared to more strict sanitation standards. Figures 18 and 19 display the estimated percentage of the national urban and rural population relying on different sanitation solutions. Rates for improved sanitation surpass 60% coverage in all urban and in most rural areas, but the rates of population connected to a sewer network are considerably lower, even in urban areas, where this type of system is most appropriate.

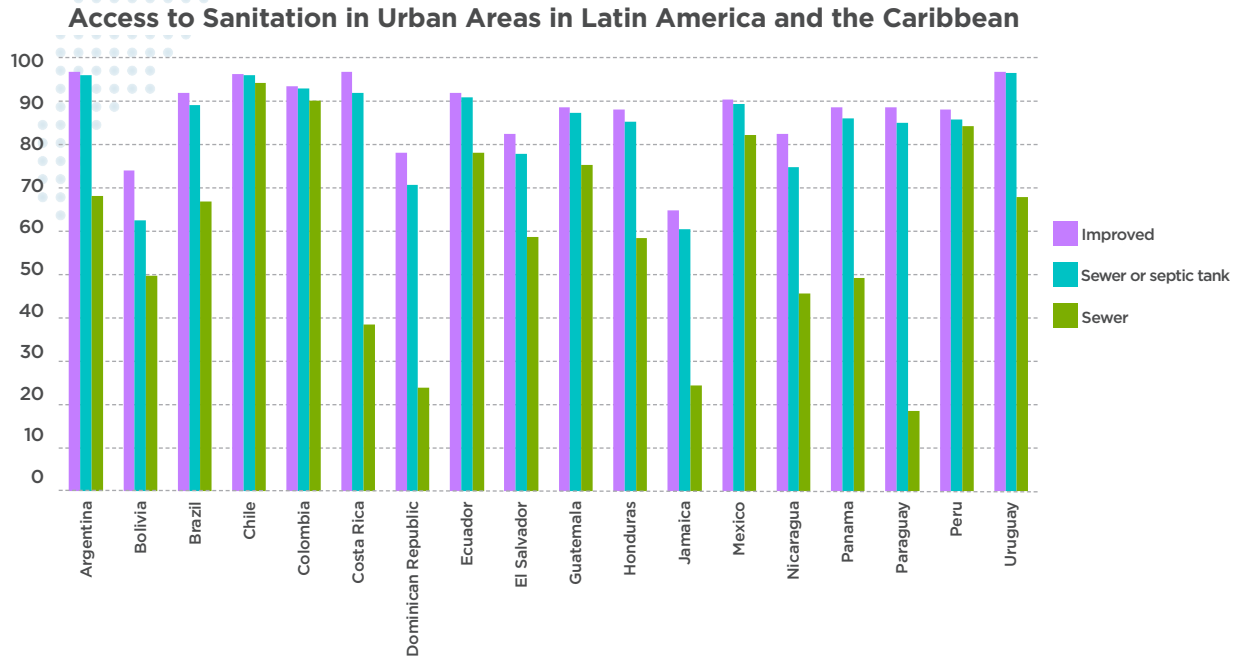

Figure 18: Access to Sanitation (Urban)
Note: Bars show the estimated percentage of the urban population whose sanitation access falls into each of three categories: improved (see definition in (cite WHO UNICEF)), sewer or septic tank, and sewer.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave, 2018 Bolivian Household Survey and 2018 Peruvian National Household Survey. Methodological details included in Appendix A.

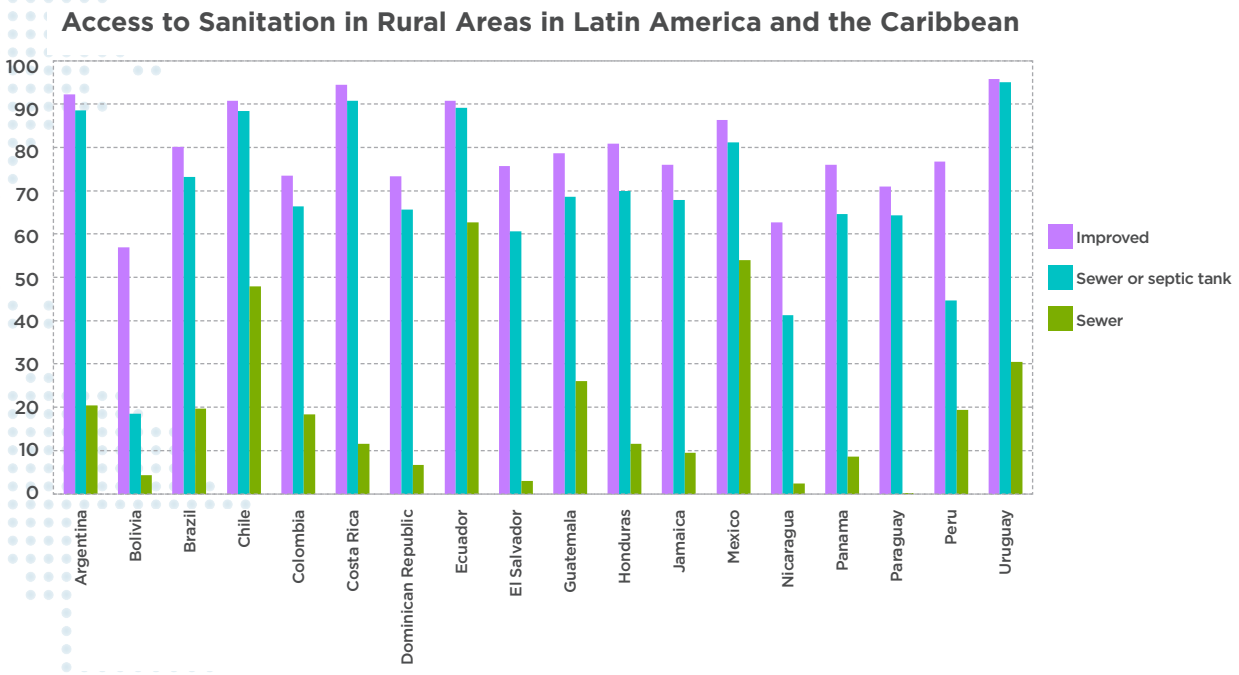

Figure 19: Access to Sanitation (Rural)
Note: Bars show the estimated percentage of the rural population whose sanitation access fall into each of three categories: improved (see definition in (cite WHO UNICEF)), sewer or septic tank, and sewer.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave, 2018 Bolivian Household Survey and 2018 Peruvian National Household Survey. Methodological details included in Appendix A.

Following indicator 6.2.1, in addition to counting on a solution considered to be "improved", households are required to have access to a sanitation facility that is not shared with other households. In cases where improved facilities are shared, the JMP standards suggest defining these services as "limited". Figure 20 shows that the share of households that report sharing facilities is relatively low across countries. The country with the biggest share, Jamaica, has less than one in every four households sharing facilities.

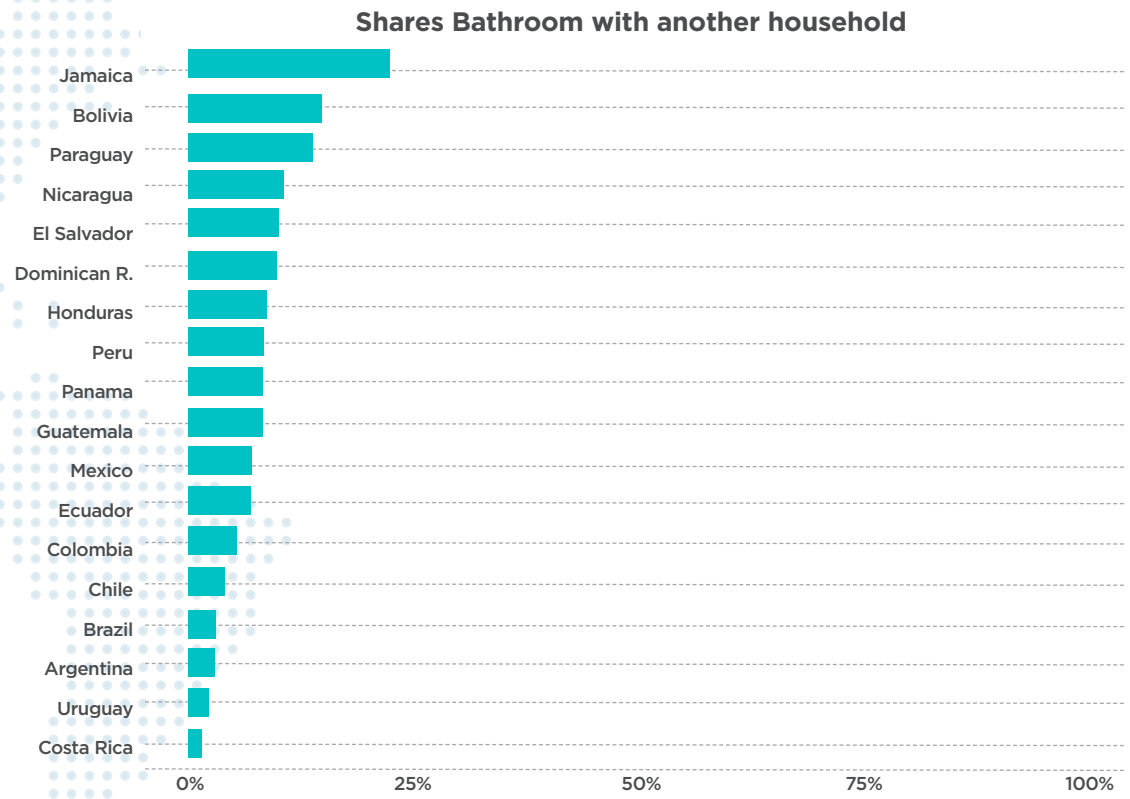

Figure 20: Shared Bathroom Facilities
Note: The bars in the graph represent the share of responses "Yes" to the question, "Do you share this facility with other households?" per country.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

The flipside of this definition includes sanitation services that do not comply with any of the aforementioned criteria. Sanitation facilities such as pit latrines or containers, connected (in some cases) to tubing directed to waterways or discharged somewhere else, are considered unimproved. Figure 21 shows that in most countries, the share of responses considered as unimproved sanitation did not surpass 25%. The exceptions, Jamaica and Nicaragua, reported a share of unimproved sanitation services between 31% and 36%.

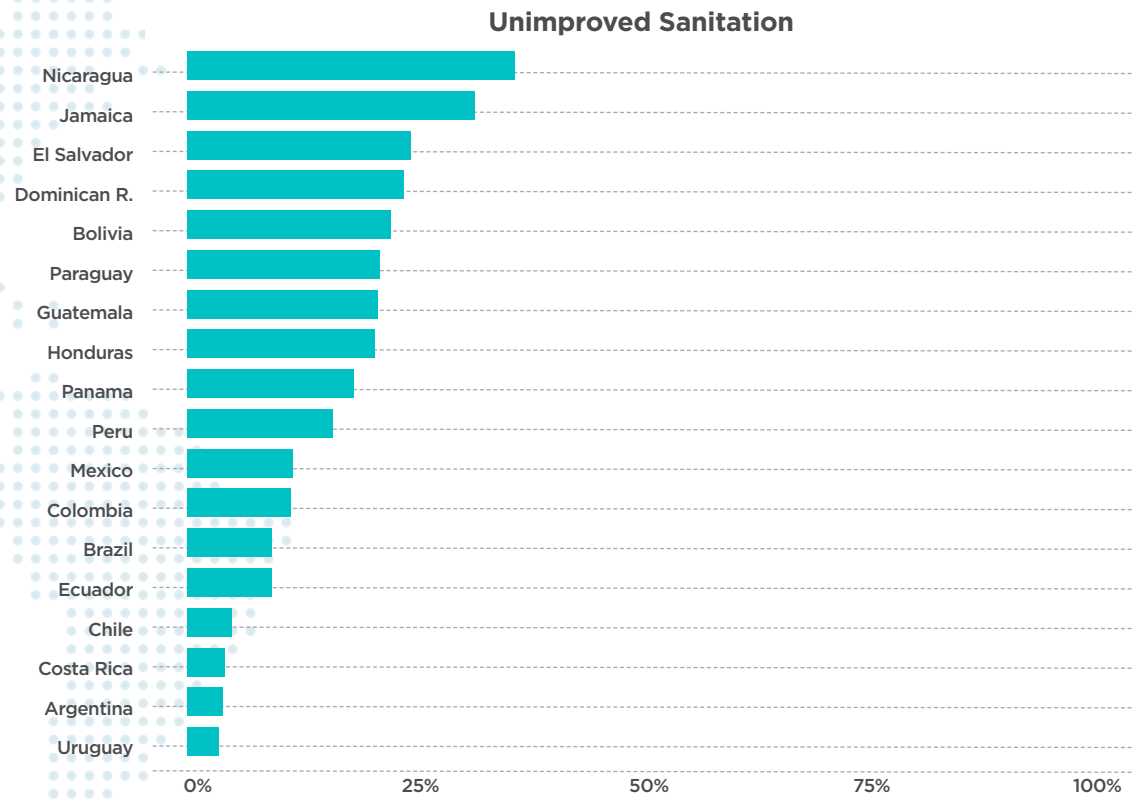

Figure 21: Unimproved Sanitation
Note: The bars in the graph represent the share of responses that fall within the unimproved category per country.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

Understanding the reasons behind this state of affairs is important to close the sanitation gap. In six of the countries surveyed, respondents were asked about the reasons why they were not connected to the sewer system, which is considered the best alternative for access to safely managed sanitation (mostly in urban areas). Figure 22 shows on the top panel the distribution of respondents who were not connected to the sewer system, and, on the bottom panel, the reported reasons why they were not connected. The share of respondents who were not connected to the sewer system varied between 10% (in Chile) and 60% (in Panama). Similar to the categories considered for access to water services, responses are grouped into three categories. The first refers to cost issues, labelled

"cost too high" (either cost of service or of installation). The second refers to matters of preference, labelled "prefers current system". The third refers to the perceived unavailability of the service. Similar to the case of water services, the most common answer was that the system was not available, which in many instances was conveyed as a lack of interest on the part of the utility to provide the service. Once again, these answers could mean the need to invest in additional infrastructure to extend coverage, and/or increase availability of information and communication outreach to potential consumers who might not be aware of service availability in their area.

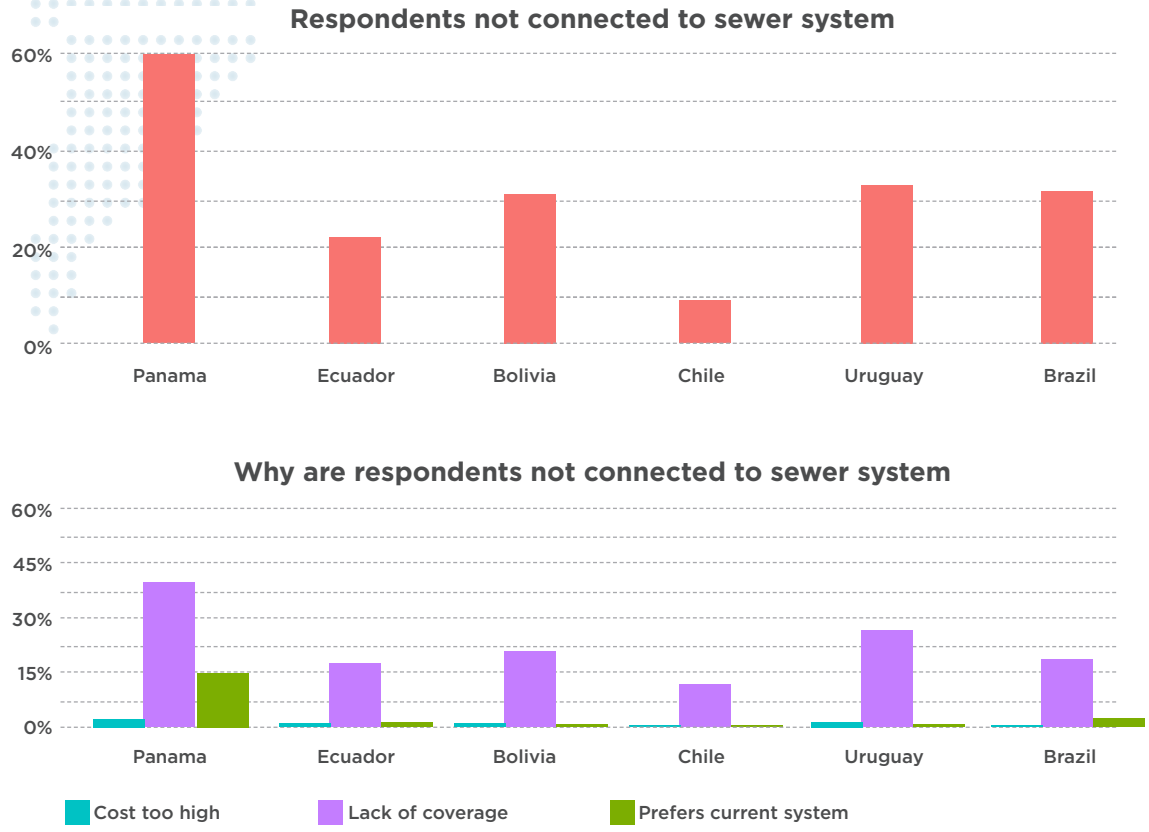

Figure 22: Respondents Not Connected to Sanitation Services and Why
Note: The top panel displays the percentage of respondents who reported no access to a sewer system. The bottom panel shows the percentages of respondents who mentioned the costs of connection and service provision, the lack of a piped network in their area, or a preference for their current method of sanitation as a reason for not being connected to the piped network.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

The last two dimensions of indicator 6.2.1, about wastewater treatment and handwashing, were not covered by the study. The small sample size of the LAPOP and predominantly urban population in the region, yielded very little variation during the pilot regarding handwashing, making its absence difficult to estimate. Wastewater treatment rates, in turn, are very complex to measure. For households connected to a sewer network, information needs to come from the utility. Users are often unaware of what happens to their wastewater once it is collected. For households relying on individual solutions, the only information we can obtain is about how often they empty their tanks and latrines, and in some cases, it is still unknown to them what happens to the contents once a company performs the service.

Overall, access to sanitation follows similar patterns as access to water, but at considerably lower levels. The move from the MDGs to the SDGs have significantly increased the standards that need to be met, resulting in low coverage rates in the region. This poses enormous challenges for countries. The widespread view among those without a connection to a sewer network is that the infrastructure is not available or that the provider lacks interest in providing it. Closing these gaps calls for joint efforts among governments and regulators, service providers, and consumers.

There is one last factor considered in the analysis of sanitation that is not directly incorporated in the definition of safely managed sanitation, but that has a direct and indirect impact on it: waste disposal. Approaches to waste disposal and treatment have direct consequences for how safely managed water and sanitation services are, given the potential for increased pollution and challenges associated with wastewater treatment.

Respondents were asked about how they usually disposed of their waste. Figure 23 shows the distribution of the responses. In all countries, the overwhelming majority of respondents indicated they disposed of their garbage through formal collection services (that is, a formal pick-up system established by local authorities, disposal at community-based containers, or pick up services provided by other sources).

However, a relatively large share of respondents in some countries reported burning their trash. This share varied from 37% (in Paraguay) to less than 1% (Chile). Much less variation was found in the share of respondents who reported recycling their waste, through formal or informal mechanisms. In all countries, the share of respondents who chose that category (which included the options "making fertilizer/compost", "recycling at home", "taking it to the recycling center" or household recycling collection options, formal or informal) did not reach more than 7%. This shows that, from the consumers' perspective, their behavior is anchored in traditional waste disposal practices and only a very small minority has moved into more sustainable ways of disposing of their trash. This last point is directly related with the next and final section of this analysis, which explores the results of the relationship between service provision and climate change.

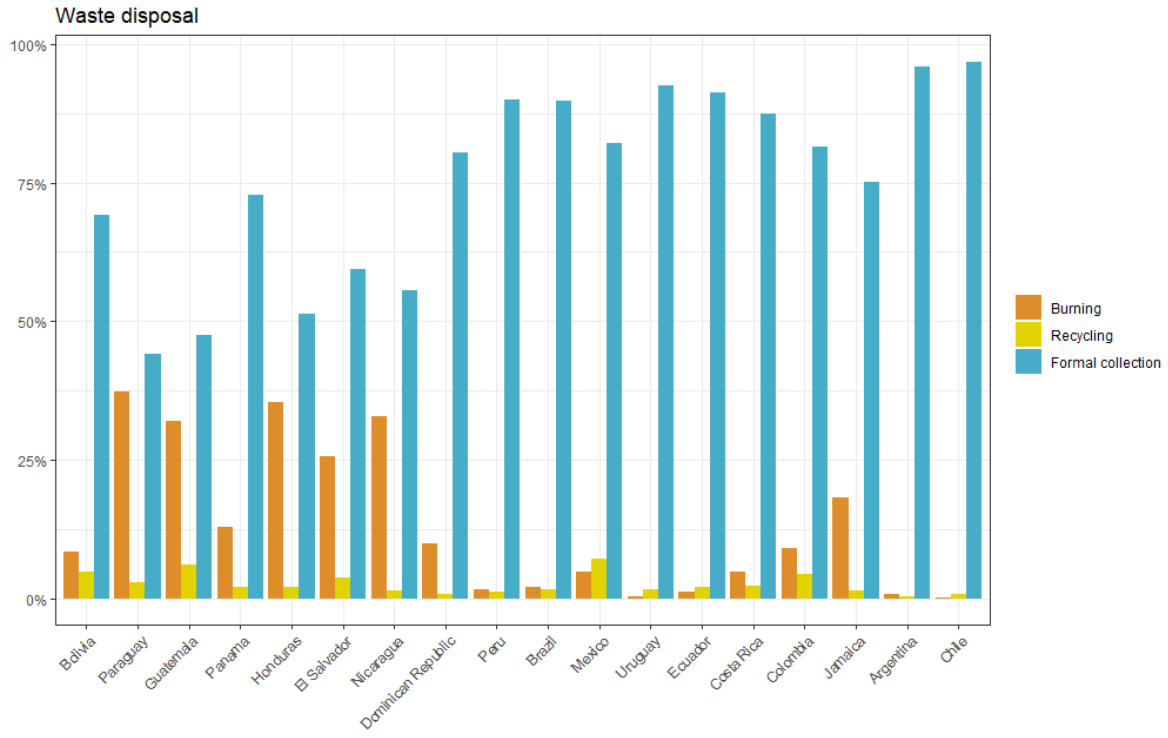

Figure 23: Waste Disposal
Note: Each column represents the share of respondents per country that answered to one of the three categories based on responses to the question, "Please, can you tell me how you dispose of the garbage in this household?"
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

Service Provision and Climate Change

Most of the report has focused on SDG Goal 6, primarily from the perspective of targets 6.1 and 6.2. One important threat to achieving these targets is climate change, due to the increasing frequency and severity of extreme weather events that can impact service continuity and water quality. These targets are related to each other, and to the rest of the targets in Goal 6. An additional target greatly impacted by climate change is 6.4, which seeks to "increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity" (United Nations, 2015). Droughts and floods, in particular, are climate change-related events that could greatly impact all of these targets.

The impact of these events depends on several factors; the most important one is event frequency. To get a better sense of the frequency of droughts and floods in the region, respondents were asked whether they had experienced floods and droughts in the previous three years. Figure 24 shows the results for droughts, and Figure 25 shows the distribution for floods. These results show a wide variation across events and countries. The first result to consider is the overall frequency of each event. Based on these responses, droughts affect a higher share of the population across Latin America and the Caribbean than floods. Yet the difference is stark across countries. While countries like Chile and Uruguay have only about 7% of respondents having lived through droughts recently, Jamaica finds itself in the opposite extreme of the distribution, with over 57% of respondents having experienced droughts. In most cases, however, the share of respondents who have lived through droughts is less than 30%.

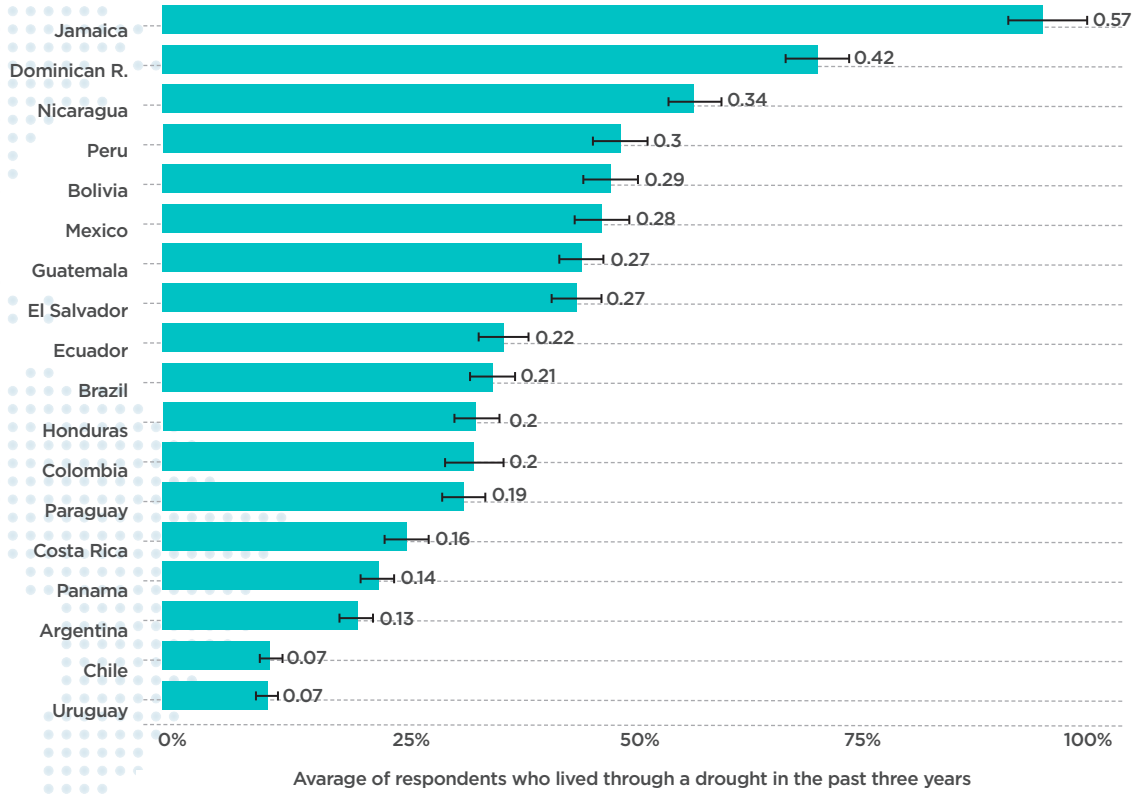

Figure 24: Share of Respondents Who Experienced Droughts in the Past Three Years
Note: Each bar represents average number of respondents per country who reported having experienced droughts in the past three years. The error bars in each column represent the lower and upper bounds of these averages, calculated as one standard deviation below and above the average per country.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

Figure 25 shows results for the same question, focused on floods instead. In this case, the variation is much smaller across countries. The share of respondents having experienced a flood in the past three years varies from 5% (in Chile) to 21% (in Bolivia). Overall, the percentage of respondents experiencing floods is much lower than those who have experienced droughts, with almost all responses below 15%. These results, while relatively positive, are not fully representative of the severity of these events. Further analysis focused on their occurrence and impact on access to water, water quality and water stress, are fundamental for understanding the unique challenges faced by the Latin American and Caribbean region. Recent occurrences of such events, like floods and

landslides produced by tropical storm Eta in Central America in November 2020, are reminders that these phenomena need further exploration to improve policymaking in the water and sanitation sector.

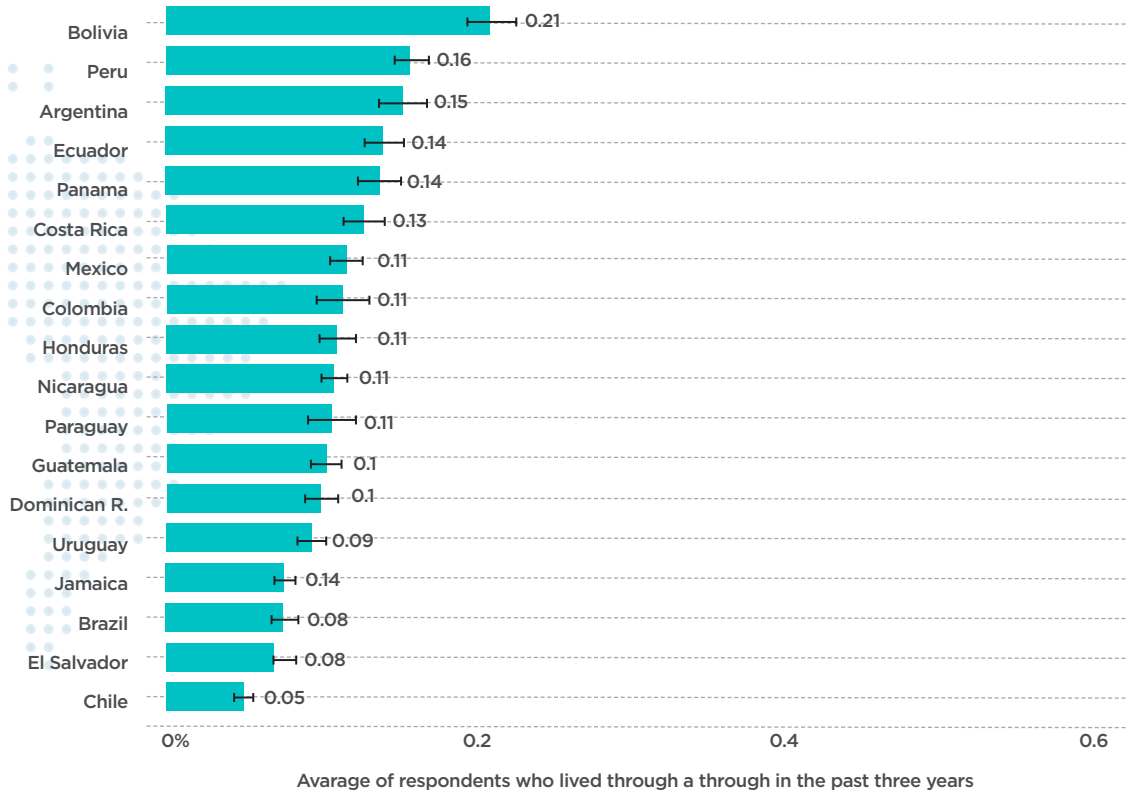

Figure 25: Share of Respondents Who Experienced Floods in the Past Three Years
Note: Each bar represents average number of respondents per country who reported having experienced floods in the past three years. The error bars in each column represent the lower and upper bounds of these averages, calculated as one standard deviation below and above the average per country.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

Climate change and related extreme weather events result from, and are exacerbated by, human behavior. However, the hardest challenge to tackle as a society is identifying what the best course of action is, and who is responsible for taking the lead. The last question included in this analysis addresses this challenge. To understand individuals' perspectives on who is responsible for extreme events, respondents answered who

was responsible for droughts and floods. For benchmarking purposes, respondents were also asked who was responsible for blackouts, another event that is not as directly associated with climate change, but still can be extremely disruptive for everyday life. Figure 26 shows the results for these questions.

Exploring these results, the favorite culprit for blackouts across all countries is the utility company. However, this is not the case for droughts, for which respondents chose to place responsibility on climate change or people and human behavior first. Similarly, respondents chose climate change as the most popular response for floods, followed, in most cases, by people and human behavior. Strikingly, across all three events, governments tended to be the least popular option among respondents.

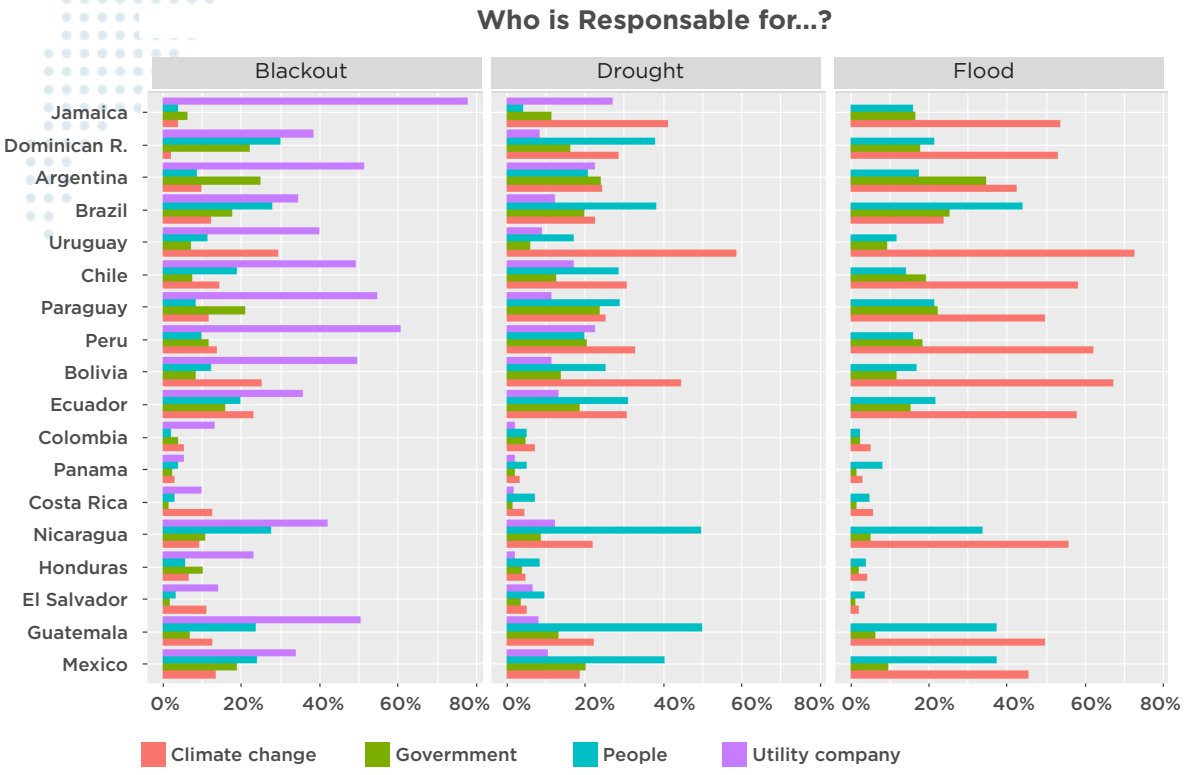

Figure 26: Who is Responsible for...
Note: Each panel represents one of the three events (blackouts, droughts and floods), and each column within panels represents the share of respondents per country that answered in each category.
Source: Elaborated by the authors based on data from the LAPOP 2018-2019 wave. Methodological details included in Appendix A.

These results, combined with responses in previous sections regarding saving water and awareness of water provision cost and bill payment, present a puzzling scenario to resolve. Consumers have limited awareness about the cost of providing water, and do not report behavior consistent with saving water. At the same time, they are less likely to support increments in their bills, and they are more likely to place responsibility for extreme conditions on human behavior than on governments and utility providers. The challenge ahead, then, is how to provide the right incentives to governments and utilities to increase access and quality of service when, overall, people seem to be satisfied with the service they receive and might not hold governments and utilities accountable for improvements needed. Simultaneously, this analysis suggests a contradiction between assigning responsibility to human behavior for extreme events, yet not displaying signs of sustainable behavior, such as recycling or saving water.

Conclusion

The Sustainable Development Goals (SDGs) and the 2030 Agenda represent a roadmap for efforts in international development to promote and guarantee human dignity, peace, and prosperity across the globe. Tracking their progress is a fundamental part of this effort, yet the task is one of outstanding complexity. In the Water and Sanitation sector, lack of adequate, representative, and comparable data has made the tracking of Goal 6 particularly challenging. The present report has addressed a small part of this challenge by providing an original dataset, gathered in partnership with Vanderbilt University's Latin American Public Opinion Project (LAPOP), and an extensive diagnosis on the realities and gaps in Latin America and the Caribbean.

These efforts represent an important step but are far from complete. While the data collected represent a comparable, nationally representative, and reliable diagnosis of the current situation in the water and sanitation sector, it still has clear limitations. First, sample sizes per country make this survey representative of national populations, both in urban and rural areas. However, Latin America is a highly urbanized region, making access to small and remote rural areas difficult and less probable to be included in the sample. These areas, where service gaps tend to be most prevalent, require more tailored efforts to characterize their realities in detail. The LAPOP samples were also characterized by a higher average educational attainment than official household surveys in some countries; thus, results should be interpreted as an upper bound of service access and quality rates. Finally, measuring access to sanitation and quality of service is particularly difficult given the proposed criteria that SDG target 6.2.1 presents. While measuring access to sanitation by types of solution can provide a clearer diagnosis, additional challenges remain.

Three main takeaways stand out from this report. First, the SDGs include several dimensions of service provision that need to be evaluated separately in order to better inform policy-making. The changes from the MDG to the SDG have considerably raised standards for access and quality of water and sanitation services. To achieve these new standards, it is also necessary to pay closer attention to each of the components within each target, as more in-depth examination provides a much more heterogenous scenario across and within countries. Two countries with the same overall score in SDG Goal 6.1, for example, may be characterized by very different realities. In one case, the main challenge may be improving water access from "improved" to "located close to home", while in others the biggest gap may be related to service continuity or even quality issues. As a result, the corresponding policies required to address these issues might be very different.

This argument about nuances of measurement and diagnoses extends across the board, and within each category. For example, issues about access to water service include how far the water source is from the home. Regarding continuity issues, turning the criterion "available when needed" into a specific time frame (whether that is two days a week or 10 hours per day, to even 24/7) poses additional challenges. Even from the perspective of water quality, what parameters are required for water to be considered "potable" make these nuances significant for the diagnosis and policymaking necessary to achieve SDG 6.

Another finding that bears further investigation is consumers' awareness and access to information regarding water and sanitation services they have (or could have) access to. The report highlights the tensions between lack of clarity about cost of service, unwillingness to pay higher bills for it, and a wide variation in adoption of water saving strategies. Based on these elements, it is necessary to continue exploring the information and incentives that consumers, providers, and governments face as part of the water sector. The expansion of service coverage and the sustainability of water and sanitation services rely on it.

In sum, this report presents a diagnosis that contributes to current efforts in measuring and tracking progress of the Sustainable Development Goals in Latin America and the Caribbean, and specifically of Goal 6, "Ensure availability and sustainable management of water and sanitation for all". The results presented provide a first step in gathering comparable, representative and reliable data that provide a closer look at indicators within each target, improve the quality of the diagnosis across Latin America and the Caribbean and inform and strengthen the efficiency of policymaking in the water and sanitation sector.

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Appendix

Appendix A - Methodology

This appendix presents additional methodological details regarding the data analysis work for this report. The results presented in this report have been calculated using the 2018-2019 LAPOP wave, and weighing the results cross-nationally using the *survey* package in R. Following methodological instructions suggested by LAPOP, the survey design used for these calculations was:

svydesign(ids=~upm, strata=~strata, weights = ~weight1500, nest=TRUE, data=merge)

Below, we enumerate the recodification and categorization of variables for visual presentation in each graph included in this report.

Figure 1 and Figure 2: Access to Water Services (Urban and Rural)

Figures 1 and 2 present the share of population with access to water services across countries in Latin America and the Caribbean, divided by urban and rural sectors, and considering three main categories: "Improved" (sources include pipes, protected wells, rainwater or protected springs), "Piped to dwelling" (water piped into the yard or inside the house), and "Piped to house" (water piped inside the house itself). The percentages presented in these figures were calculated based on percentage of respondents in each country who answered the question of the 2018-2019 LAPOP survey presented below.

Question: What is the main source of drinking water for members of your household?

(01) Piped water/public water pipe/tap water into dwelling/house
(02) Piped water to yard/plot
(03) Irregular connection (stealing) to public water pipe
(04) Public tap/ standpipe /tank
(05) Tube well/borehole (with pump)
(06) Protected dug well (without pump)
(07) Unprotected dug well (without pump)
(08) Protected spring
(09) Unprotected spring
(10) Rainwater collection
(11) Bottled water (water bags)
(12) Cart with small tank/drum

(13) Tanker truck
(14) River, creek, stream, canal, irrigation channels
(77) Other
Improved sources were defined as responses to options 01, 02, 06, 08, and 10. "Piped to dwelling" was defined as responses to options 01 and 02, and "Piped to house" was defined as option 01.

In the case of Bolivia and Peru (rural), the source of data used for this figure was each country's 2018 National Household Survey. This decision was made based on results by Datshkovsky and Machado (forthcoming), which present a gap surpassing 20 percentage points between estimates using LAPOP data and national household surveys in these cases (both also contrasted with JMP data and standards). Therefore, using data from national household surveys in these two cases allowed for a more conservative, yet representative, result.

Figure 3: Respondents Not Connected to Water Services and Why

Figure 3 presents the share of respondents who reported not being connected to water services, and the reasons why. The share of respondents who were not connected to water services was calculated based on the same question used for Figures 1 and 2. In this case, the categories considered for calculating these percentages were all but options 01 and 02. The distribution of reasons why these respondents were not connected was calculated based on responses to the question presented below. This question was only asked to those who reported not being connected to the water system. Distribution of those responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. In this case, each column represents the share of respondents per country that answered in each category. Categories were recodified for visualization purposes, using the following protocol: "Cost" includes categories 2 and 3, "No service available" includes categories 1 and 8, and "Prefers current system" includes categories 4 through 7.

Question: Why are you not connected to the water system?

(1) System does not cover my house
(2) Tariff for connecting to the system is too high
(3) Tariff cost for the service after connecting is too high
(4) I think that the system I currently use is better
(5) I do not want to break my floor/requires work within the house to connect

(6) I am comfortable with the system I currently use, and I would rather not change it
(7) The system I use is the most popular one in this neighborhood
(8) Authorities/water provider is not interested in offering services here

Figure 4: Days per Week with Access to Water Services

Figure 4 presents the distribution of responses per country to the question, "How many days a week do you receive water from the water piping/public water line?" The wording of this question is included below. Distribution of those responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons.

Question: How many days a week do you receive water from the water piping/public water line?

(0) Less than once a week
(1) One day a week
(2) Two days per week
(3) Three days per week
(4) Four days per week
(5) Five days per week
(6) Six days per week
(7) Seven days per week

Figure 5: Hours per day with Access to Water Services

Figure 5 presents the distribution of responses per country to the question, "How many hours or water per day do you get during the days you have service?" Responses were numeric extending from 0 to 24. Distribution of those responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons.

Figure 6: 24 Hours of Water Service per Day

Figure 6 presents the share of respondents per country that reported receiving 24 hours of water service per day every day. The share of responses was calculated based on the number of respondents who reported "24 hours" to the question for Figure 5. Distribution of those responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons.

Figure 7: Monthly Average Interruptions of Water Service

Figure 7 presents the monthly average number of interruptions of water service reported by respondents per country. The distribution presented was calculated by taking the weighted means across countries for the question, "During the past four weeks, how many times has the regular water service been interrupted?". Answers were numerical and could range from 0 to 50. The error bars in each column represent the lower and upper bounds of these averages, calculated as one standard deviation below and above the average per country. These means were calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons.

Figure 8: Quality of Water – Pressure

Figure 8 presents the distribution of responses for the question, "You would say that water pressure in your household is…", following the wording and categories presented below. Distribution of those responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. For visualization purposes, categories "Good" and "Very good" were aggregated into "Good or very good", and categories "Bad" and "Very bad" were aggregated into "Bad or very bad".

Question: You would say that water pressure in your household is…

(1) Very good
(2) Good
(3) Not good nor bad (Regular)
(4) Bad
(5) Very bad

Figure 9: Quality of Water - Cleanliness

Figure 9 presents the distribution of responses for the question, "You would say that water cleanliness in your household is…", following the wording and categories presented below. Distribution of those responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional

comparisons. For visualization purposes, categories “Good” and “Very good” were aggregated into “Good or very good”, and categories “Bad” and “Very bad” were aggregated into “Bad or very bad”.

Question: You would say that water cleanliness in your household is...
(1) Very good
(2) Good
(3) Not good nor bad (Regular)
(4) Bad
(5) Very bad

Figure 10: Quality of Water - Taste

Figure 10 presents the distribution of responses for the question, “You would say that water taste in your household is...”, following the wording and categories presented below. Distribution of those responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. For visualization purposes, categories “Good” and “Very good” were aggregated into “Good or very good”, and categories “Bad” and “Very bad” were aggregated into “Bad or very bad”.

Question: You would say that water cleanliness in your household is...
(1) Very good
(2) Good
(3) Not good nor bad (Regular)
(4) Bad
(5) Very bad

Figure 11: Sources of Water for Multiple Purposes

Figure 11 presents the distribution of responses per country for three potential answers to the question, “What is the main source of water used by your household for other purposes, such as cooking and hand washing?” The complete question with all categories is included below. Distribution of those responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. For visualization purposes, the graph includes only three categories: “Bottled” (option 11), “Piped” (options 01 and 02) and “Unimproved” (following JMP standards, this category includes options 7, 9, 11 through 14, and 77).

Question: What is the main source of water used by your household for other purposes, such as cooking and hand washing?

(01) Piped water/public water pipe/tap water into dwelling/home
(02) Piped water to yard/plot
(03) Irregular connection (stealing) to public water pipe
(04) Public tap/standpipe/tank
(05) Tube well/borehole (with pump)
(06) Protected dug well (without pump)
(07) Unprotected dug well (without pump)
(08) Protected spring
(09) Unprotected spring
(10) Rainwater collection
(11) Bottled water (water bags)
(12) Cart with small tank/drum
(13) Tanker truck
(14) River, creek, stream, canal, irrigation channels
(77) Other

Figure 12: Having Access to Piped Water vs Using Bottled Water for Consumption

Figure 12 presents the share of respondents who report having access to piped water in comparison with the share of respondents who report using bottled water for their household consumption. These percentages were calculated, per country, based on responses to the question, "What is the main source of drinking water for members of your household?", included in its entirety below. Distribution of those responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. In this figure, "Bottled" corresponds to the share of responses for option 11, and "Piped" corresponds to the share of responses for options 01 and 02.

Question: What is the main source of drinking-water for members of your household?

(01) Piped water/public water pipe/tap water into dwelling/house
(02) Piped water to yard/plot
(03) Irregular connection (stealing) to public water pipe
(04) Public tap/ standpipe /tank
(05) Tube well/borehole (with pump)
(06) Protected dug well (without pump)

(07) Unprotected dug well (without pump)
(08) Protected spring
(09) Unprotected spring
(10) Rainwater collection
(11) Bottled water (water bags)
(12) Cart with small tank/drum
(13) Tanker truck
(14) River, creek, stream, canal, irrigation channels
(77) Other

Figure 13: How Much Do You Currently Pay for Your Monthly Household Consumption? (Up to US$75)

Figure 13 presents the responses to the question, "How much do you currently pay for your monthly household consumption?" per country, which were numerical and had no specific range. Responses to this question were not weighted. Instead, all responses were transformed to US dollars for comparison, using the contemporary national exchange rate at the end date for fieldwork in each country. The table with the corresponding exchange rates is included below. Additionally, the variation in responses made the visualization less clear. Therefore, Figure 13 only includes responses that reach up to US$75. Figure 13 bis included in this segment shows the original distribution of responses, including all outliers.

Pais	Survey end date	Exchange rate
Mexico	3/27/2019	19.32644
Guatemala	3/27/2019	7.68898
El Salvador	3/27/2018	1
Honduras	3/27/2018	24.2367
Nicaragua	3/27/2018	31.3995
Costa Rica	3/27/2018	620.64
Panama	3/27/2018	1
Colombia	3/27/2018	3,276.79
Ecuador	3/27/2019	1
Bolivia	3/27/2019	6.91
Peru	3/27/2019	3.30275
Paraguay	3/27/2019	6210
Chile	3/27/2019	683.39
Uruguay	3/27/2019	35.26
Brazil	3/27/2019	3.77705
Argentina	3/27/2019	42.73145
Dominican Republic	3/27/2019	50.403
Jamaica	3/27/2019	128.94425

Table 1: SDG 6.1 Drinking Water

Exchange rates
Source: IDB Exchange Rate
Figure 13bis

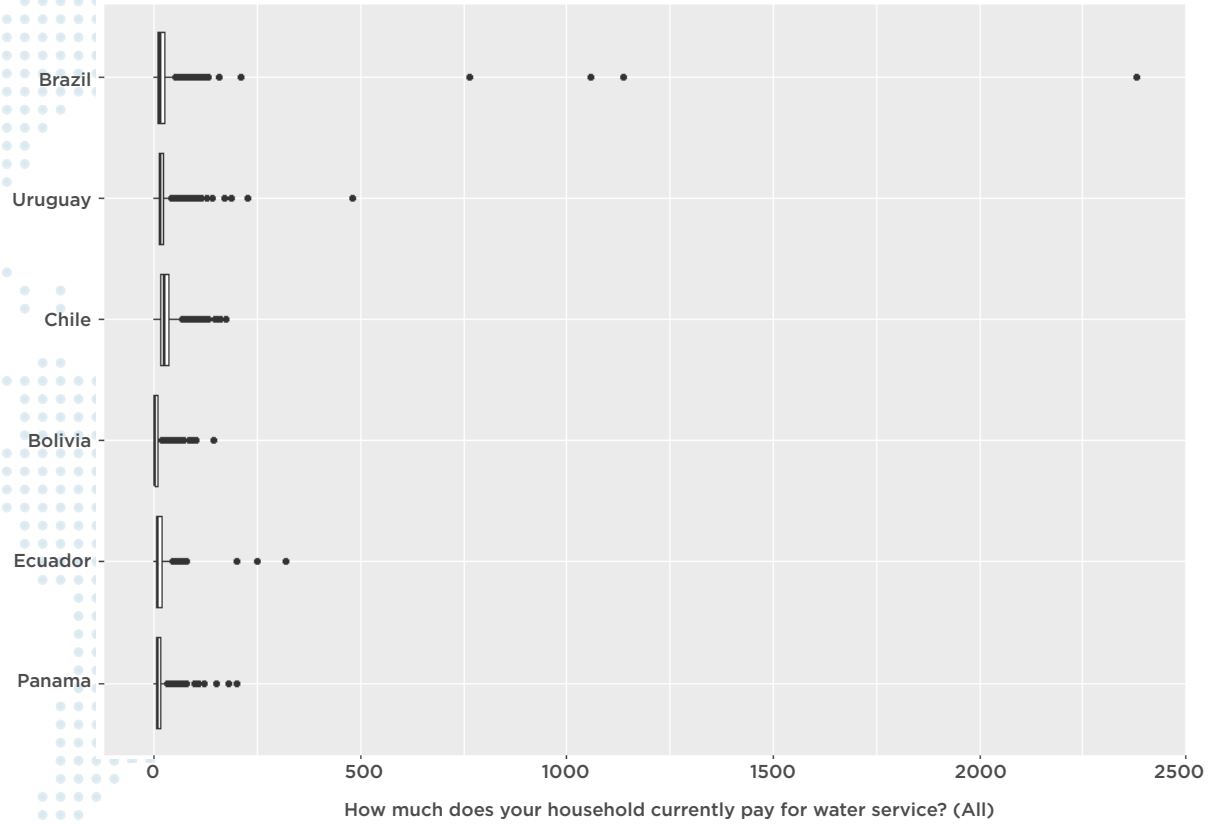

Figure 14: Out of the Last 6 Bills, Have You Not Paid Any?

Figure 14 presents the distribution of responses to the question, "Of the past six water bills you received, did you not pay any?" per country, which was numerical, with a range of 1 through 6, or 0 as "No". Complete question and wording are included below. Responses are presented following the same categorization in this figure. Distribution of these responses is calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. The bars in each graph represent the share of that number of unpaid bills reported per country. Category "unpaid bills" represents the share of all unpaid bills reported per country. For visualization purposes, categories 0 ("No) and 7 ("Did not pay because did not receive the bill") were omitted.

Question: Sometimes, people do not pay their water bills for different reasons: they do not believe it is important, they believe water should be free, or they cannot afford it. Of the past six water bills you received; did you not pay any? [Values accepted 1-6]

(0) No
(7) Did not pay because did not receive the bill

Figure 15: The Price I Pay for Water Services Should Be…

Figure 15 presents the distribution of responses to the question, "Thinking about how much your household pays for water, which of the following statements reflect your opinion?" per country. Complete question and wording are included below. Responses are presented following the same categorization in this figure. Distribution of these responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. The bars in each graph represent the share of responses for each option per country.

Question: Thinking about how much your household pays for water, which of the following statements reflect your opinion?
(1) The price should be lower
(2) The price should be the same
(3) The price should be higher

Figure 16: Is There a Meter?

Figure 16 presents the distribution of responses to the question, "Is there a meter in your household to know how much water you consume?" per country. Complete question and wording are included below. Responses are presented following the same categorization in this figure. Distribution of these responses is calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. The bars in the graph represent the share of responses for each option per country.

Question: Is there a meter in your household to know how much water you consume?
(1) There is no meter
(2) There is an individual one (just for this household)
(3) There is a communal one (for the building or community)

Figure 17: Do You or Members of Your Home Take Any Measures to Save Water?

Figure 17 presents the distribution of responses to the question, "Do you or members of your household take any measures for saving water?" per country. Complete question and wording are included below. The responses presented are following the same categorization, but only for responses

that report taking measures of any kind. That is, those who responded not taking any measures were excluded for visualization purposes. Distribution of these responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. The bars in the graph represent the share of responses for each option per country. The lowest bar in each graph, "Takes measures (total)," represents the total share of positive responses per country.

Question: Do you or members of your household take any measures for saving water?
(1) No measure
(2) Reduce use in personal hygiene (shortening showers, turning off tap when brushing teeth or washing hands)
(3) Use-water saving toilet system
(4) Use pail, bucket, sink for cleaning (dishes, cars, sidewalks)
(5) Use alternative sources for irrigation
(6) Use short cycles in household appliances (washing machine, dishwasher)
(7) Use timers/pressure reducers
(8) Reuse water (from showers or cleaning) for other purposes
(9) Other measures

Figure 18 and Figure 19: Access to Sanitation (Urban and Rural)

Figures 18 and 19 present the share of population with access to sanitation services across countries in Latin America and the Caribbean, divided by urban and rural sectors, and considering three main categories: "Improved" (either a flush toilet or latrine that separates excreta from human contact and is used by only one household), "Sewer and septic tank" (sanitation system in which the excreta is either connected to sewage pipes or a septic system), and "Sewer" (sanitation system in which the household is connected to sewage pipes). The percentages presented in these figures were calculated based on percentage of respondents in each country who answered to the questions of the 2018-2019 LAPOP survey presented below.

Question 1: The bathroom or toilet facility/sanitary in this household is connected to...
(1) Piped sewer system
(7) Connected to treatment plant/system
(2) Septic tank/hole outside the house

(3) Tubing flowing to creek/waterway
(4) Other [flows/discharges somewhere else]
(5) Flows/discharges to unknown place/not sure/does not know where
(6) Cesspit not connected to any system

Question 2: What do you use in your household as a bathroom?
(1) Ventilated pit latrine
(2) Pit latrine with slab/toilet
(3) Pit latrine without slab/toilet/open pit
(4) Composting toilet/dry toilet/eco toilet
(5) Bucket
(6) Hanging toilet/hanging latrine
(7) No facilities or uses bush or field
(77) Other

Question 3: Do you share this facility with other households?
(1) Yes
(2) No

"Improved" sources were defined as responses to options 1, 2, and 7 in Question 1, options 1, 2 and 4 in Question 2, and option 1 to Question 3. "Sewer and septic tank" were defined as responses to options 01 and 02 and option 1 in Question 2, and "Sewer" was defined as option 01 in Question 1 and option 1 in Question 2.

In the case of Bolivia and Peru (rural), the source of data used for this figure was each country's 2018 National Household Survey. This decision was made based on results by Datshkovsky and Machado (forthcoming), which present a gap surpassing 20 percentage points between estimates using LAPOP data and national household surveys in these cases (both also contrasted with JMP data and standards). Therefore, using data from national household surveys in these two cases allowed for a more conservative, yet representative, result.

Figure 20: Shared Bathroom Facilities

Figure 20 presents the distribution of responses to the question, "Do you share this facility with other households?" per country. Complete question and wording are included below. Distribution of these responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. The bars in the graph represent the share of responses "Yes" per country.

Question: Do you share this facility with other households?
(1) Yes
(2) No

Figure 21: Unimproved Sanitation

Figure 21 presents the share of population with access to unimproved sanitation services across countries in Latin America and the Caribbean. Unimproved services were defined based on answers to three questions presented below, also used for Figures 18 and 19. Unimproved services are defined by responses 3, 4, 5, and 6 for Question 1, and/or responses 3, 5, 6, 7 and 77 for Question 2, and/or response 1 for Question 3. Complete question and wording are included below. Distribution of these responses is calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. The bars in the graph represent the share of responses that fall within the unimproved category per country.

Question 1: The bathroom or toilet facility/sanitary in this household is connected to...
(1) Piped sewer system
(7) Connected to treatment plant/system
(2) Septic tank/hole outside the house
(3) Tubing flowing to creek/waterway
(4) Other [flows/discharges somewhere else]
(5) Flows/discharges to unknown place/not sure/does not know where
(6) Cesspit not connected to any system

Question 2: What do you use in your household as a bathroom?
(1) Ventilated pit latrine
(2) Pit latrine with slab/toilet
(3) Pit latrine without slab/toilet/open pit
(4) Composting toilet/dry toilet/eco toilet
(5) Bucket
(6) Hanging toilet/hanging latrine
(7) No facilities or uses bush or field
(77) Other

Question 3: Do you share this facility with other households?
(1) Yes
(2) No

Figure 22: Respondents Not Connected to Sanitation Services and Why

Figure 22 presents the share of respondents who reported not being connected to sanitation services, and the reasons why. The share of respondents who were not connected to sanitation services was calculated based on the same question used for Figures 18 and 19. In this case, the categories considered for calculating these percentages were all but options 01 and 07.
The distribution of reasons why these respondents were not connected was calculated based on responses to the question presented below. This question was only asked to those who reported not being connected to the sanitation system. Distribution of those responses is calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. In this case, each column represents the share of respondents per country that answered to each category. Categories were recodified for visualization purposes, using the following protocol: "Cost" includes categories 2 and 3, "Lack of coverage" includes categories 1 and 8, and "Prefers current system" includes categories 4 through 7.

Question: Why are you not connected to the sanitation system?
(1) System does not cover my house
(2) Tariff for connecting to the system is too high
(3) Tariff cost for the service after connecting is too high
(4) I think that the system I currently use is better
(5) I do not want to break my floor/requires work within the house to connect
(6) I am comfortable with the system I currently use, and I would rather not change it
(7) The system I use is the most popular one in this neighborhood
(8) Authorities/water provider is not interested in offering services here

Figure 23: Waste Disposal

Figure 23 presents the share of responses to the question, "Please, can you tell me how you dispose of the garbage in this household?". Complete question and wording are included below. Distribution of those responses is calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. In this case, each column represents the share of respondents per country that answered to three aggregated categories. Categories were recodified for visualization purposes, using the following

protocol: “Burning” includes category 07, “Recycling” includes categories 06, 10, 11, 12 and 13, and “Formal collection” includes categories 01 and 03.

Question: Please, can you tell me how you dispose of the garbage in this household?

(01) Household waste collection (municipal/formal service)
(02) Household waste collection (informal service/garbage pickers)
(03) Disposal at neighborhood/community waste containers
(04) Take it to municipal landfill
(05) Bury it
(06) Make fertilizer/compost
(07) Burn it
(08) Disposal in vacant lot/waste land or in waterway
(09) Disposal in other/any place
(10) Recycle at home (not compost)
(11) Take it to recycling center
(12) Household recycling collection (formal/municipal)
(13) Household recycling collection (informal/garbage pickers)

Figure 24: Share of Respondents Who Experienced Droughts in the Past Three Years

Figure 24 presents the average number of respondents per country who reported having experienced droughts (option 1) in the past three years. The distribution presented was calculated by taking the weighted means across countries for the question presented below. The error bars in each column represent the lower and upper bounds of these averages, calculated as one standard deviation below and above the average per country. These means were calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons.
Question: I am going to mention a few problems that many (demonym) have had to deal with in the past years. Which of these ones have you personally, or someone within your household, experienced in the past three years?

(0) None
(1) Droughts that had resulted in water service shutoffs or water scarcity
(2) Electricity shutoffs
(3) Floods

Figure 25: Share of Respondents Who Experienced Floods in the Past Three Years

Figure 25 presents the average number of respondents per country who reported having experienced floods (option 3) in the past three years. The distribution presented was calculated by taking the weighted means across countries for the question presented below. The error bars in each column represent the lower and upper bounds of these averages, calculated as one standard deviation below and above the average per country. These means were calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons.

Question: I am going to mention a few problems that many (demonym) have had to deal with in the past years. Which of these ones have you personally, or someone within your household, experienced in the past three years?

(0) None
(1) Droughts that had resulted in water service shutoffs or water scarcity
(2) Electricity outages
(3) Floods

Figure 26: Who is Responsible for...

Figure 26 presents the share of responses for Questions 1, 2 and 3, included below. Distribution of those responses are calculated over the weighted total of observations, using weights established by LAPOP for 1,500 observations per country for regional comparisons. In this case, each panel represents one of the three questions, and each column within panels represents the share of respondents per country that answered to each category. Categories were recodified for visualization purposes, using the following protocol: "Climate change" includes category 5, "Government" includes categories 1 through 3, "People" includes category 6, and "Utility company" includes category 4 (Questions 1 and 2). Note that answers were codified for consistency across questions, so category 4 was skipped in Question 3.

Question 1: Who do you think is primarily responsible for the electricity outages?

(1) National/central government
(2) Regional/provincial/state government
(3) Local/municipal government
(4) Electricity company
(5) Climate change or extreme weather conditions
(6) People/ourselves
(77) Other


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