JOURNAL OF
EMERGING INVESTIGATORS

Article

Impacts of COVID-19 on daily water use: Have people started using more water?

Jenifer Araujo dos Santos Silva[1], Marilia Soares[1]
[1] Etec Tereza Aparecida Cardoso Nunes de Oliveira, Brazil

SUMMARY

In Sao Paulo, as well as every other city around the world, water is an invaluable natural resource. More than a necessary input for production and a strategic resource for economic development, it is vital for the maintenance of biological, geological, and chemical cycles, which keep ecosystems in balance. There is a shortage of water in the world, and this situation is aggravated by social inequality, the lack of sustainable management, and use of natural resources. The purpose of this research was to discover if, during the quarantine of COVID-19, there was an increase in the daily use of water in the city of São Paulo and, if this happened, to understand why and to investigate its impact on reservoirs. We hypothesized that, during the COVID-19 quarantine, water consumption increased exponentially due to virus precautions. Based on our hypothesis, we carried out a survey where we interviewed 100 people in the São Paulo capital. Most reported that water consumption in their homes increased, according to our research; for example, we discovered that individuals who took an average of five-minute showers increased their time to sixteen-minute showers. This phenomena worsened the water shortage situation in many reservoirs in São Paulo. The findings from our study can be used to further help solve water waste problems.

INTRODUCTION

The planet is made up of 71% water, but only 3% of that water is fresh and only 0.5% is available to humans (1). For this and other reasons, 1.1 billion people worldwide do not have access to water, and a total of 2.7 billion find water scarce for at least one month of the year (2). Thus, water is not a resource equally available to all people, and many people around the world have little access to water.

In Brazil, the water situation is a little more comfortable than in other countries regarding availability. However, the waste of water in Brazil is even higher; it is estimated that the country wastes approximately 6 billion per cubic meter of water, which is equivalent to 6 times the capacity of the Cantareira reservoir, one of the reservoirs that supplies São Paulo, the largest city in Latin America (3). In some regions, such as the North and Northeast of the country, the water waste exceeds 50%, revealing the lack of measures to combat waste that go beyond the mere social awareness of the population. In large part, the problem is caused both by the lack of maintenance of public equipment and by using cheaper materials, in addition to the high-pressure flow of reservoirs, clandestine hydraulic connections, among others. Water is one of the most important resources for human life, so humanity need take care of it.

The United Nations states that water costs should not exceed 3 % of the total family income (4). The value of the water bill of a typical family of four in São Paulo is approximately 47.54 Brazilian reais (R$); This amount is above the one recommended by the UN, as it exceeds the recommended 3 % of the monthly salary – if the family has a minimum income of R$1,192.40 (4).

The objective of this research was to find out how water consumption in the city of São Paulo was affected by COVID-19; also, to discover how it happened, why it happened, and how this situation impacted the city's reservoirs. We used official data from Sabesp (Basic Sanitation Company of the state of São Paulo) to measure the impacts of waste on the city's reservoirs.

RESULTS

A survey carried out in 2017 showed that the average per capita consumption of water used per day in São Paulo, was approximately 129 liters (4). Before the pandemic people were less careful with the amount of time they spent bathing and according to our results, during the pandemic people became more careful (**Table 1**); this fact increased the consumption of water in people's homes. During quarantine people started to wash their hands more and to take more showers, 83% of participants in our study state that their bath has radically changed with the arrival of COVID-19 (**Table 1**).

In our study, we discovered curious facts about the change in bathing between the periods before and during the quarantine. In the survey, we asked participants of both genders (male and female) to report how much time they spent in the shower before and during the COVID-19 quarantine. We found that survey participants of both genders increased the time spent bathing (**Table 2**). This observation affected the amount of water used by people daily; consequently, this increase also impacted the water bill.

In our study, we also investigated where people started to use more water in quarantine (**Table 1**) The answers were diverse, but 68% of the participants said that, by staying home more often, their idle time increased, and they spent this time performing activities that require more use of water, such as washing cars, increased frequency of cleaning with hoses, increased frequency, and duration in baths.

In the second section of research, we proposed questions to understand where people started to spend more water, to understand how much this was affected by coronavirus and how this impacted the increase in water use.

Because of the residential water consumption increased, São Paulo's reservoirs were severely affected. The Cantareira

Questions	Answers (average)
Frequency of bathing before quarantine	2 times a day
Frequency of bathing during quarantine	4 times a day
Number of minutes of shower before quarantine	Male: 9 minutes Female: 17 minutes
Number of minutes of shower after quarantine	Male: 15 minutes Female: 26 minutes
During the quarantine did you use more water?	89% said yes 7% said no change 4% said that the use of water decreased in their house
If during the quarantine you started using more water, what is the percentage increase?	31.63%
What activities do you use the most water for?	Bathing: 72% Washing car: 11% Cleaning: 10% Other: 7%
What is the value of the water bill before quarantine?	90$ Brazilian reais (approximately 16.36 American dollars)
What is the value of the water bill during quarantine?	230$ Brazilian reais (approximately 41.81 American dollars)

Table 1: Survey questions to evaluate water consumption.

system, the city's main supply system, suffered a worrying drop on October 8, 2019 (10). The system had stored 45.6% of the useful volume, a total of 448.23 billion liters of water, but on the 8th of October 2021, the reservoirs had only 29% of their capacity, which is equivalent to 285.25 billion liters (10).

$$4(169.8(30))/1000 = 20.38m^3$$

Equation 1: Equation of the average amount spent on the water bill.

The main reservoirs in the city were affected by the increase in water consumption by the population of São Paulo (**Figure 1**). we found that because of the increase in water using, the city's reservoirs were severely affected. The Cantareira reservoir lost 16.6% of its supply capacity. The Cotia reservoir had an even more worrying loss of 52%. These results demonstrated that the pandemic period was harmful to the city's reservoirs.

DISCUSSION

According to our survey, a majority (89%) of the participants noted that they increased using water in their homes during quarantine (**Table 1**), due to improved personal hygiene, but this is not the only nor the main reason for the increase. Many of the participants reported that during the period of social isolation they started to cook more at home, this situation caused a small increase in water consumption. However,

	Male (n=59)	Female (n=41)
Before covid-19	9 minutes	17 minutes
During covid-19	15 minutes	26 minutes

Table 2: Gender comparison on personal hygiene before and during the pandemic. This comparison was performed through a self-assessment that the participants performed. The minutes correspond to time spend in shower.

people from São Paulo also started to take more and much longer showers. Before the pandemic, participants took a bath on average once a day, and these baths were of approximately 13 minutes (**Table 2**). However, during the pandemic, this time became an average of 20.5 minutes, a 57.7% increase.

In addition, the city's population started to use much more water in various other activities. In the survey, many women (60%) reported that during quarantine they started being more careful with cleaning, which exponentially increased water consumption, due to activities like these requiring a lot of water. In addition, several people also reported that they increased the use of the hose to wash the garage and outside areas. This process can use up to 24 gallons of water per minute (7).

However, according to our survey, this average was carried out with 100 residents of the city of São Paulo; this average increased by 31.63 percent to 169.8 liters. This value is much higher than the 50-100 liters of water per day per person recommended by the UN (4). However, the water consumption of citizens of São Paulo is 69.8 % above the limit recommended by the UN; this situation is worrying as this value is much higher than recommended. For comparison, England uses 142 liters of water per person per day, 16.37 less than the Paulistanos (people who lives in city of São Paulo) (6).

Additionally, 40% of participants reported that they tripled th time they spent washing their car. The average amount of time they spent on this activity before quarantine was approximately 12 minutes, and during the quarantine this time increased to an average of 26.8 minutes, an increase of 123.3%. In addition to spending more time washing their cars, many of the participants said they started doing this more often.

In the city of Portsmouth, England, water use in residential environments increased 15% in quarantine. Likewise, in San

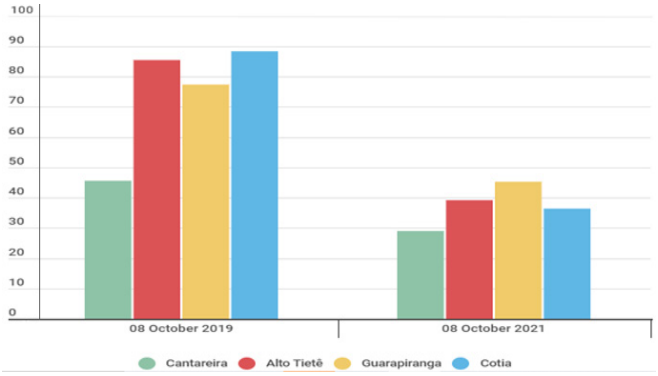

Figure 1: Comparison of the level of supply of reservoirs in the city of São Paulo before the pandemic and during the pandemic.

Francisco, California, water use in homes increased by 10% during quarantine (8). According to our water consumption survey, water in the city of São Paulo grew even more, specifically 31.63%.

In conclusion, São Paulo residents increased by 31.63% the consumption of water in households during the pandemic. The city's reservoirs were severely affected, with one of the main reservoirs, Cantareira, having suffered a 16.6% drop in its water volume. To solve the problem, Sabesp (Basic Sanitation Company of the State of São Paulo) could invest in campaigns against waste, and potentially even discount the water bill for people who saved water. Another factor that contributes to the waste of water is the old water pipes in the city, for this reason, investment must also be made in the renovation of these pipes. Finally, people need to be aware of the impact that water waste has on the environment. They need to be aware of their role in the health of the planet, so that everyone can use a resource as precious as water more wisely.

In addition, it is important to add that during the quarantine period there was no climatic or geological change to explain the change in water levels in the reservoirs.

MATERIALS AND METHODS

Ethics Statement

All research participants consented to participate and signed a document proving this.

Study Design

Our survey was named "Survey with the population of São Paulo on the impacts of COVID-19 on water consumption". The survey had 15 questions divided in two sections and the format of the questions was multiple choice. Also, 100 people were interviewed in this survey, and they spent an average of 15 minutes answering it. The questions were designed to investigate some aspects of the participants' daily water use. The first section of questions was used to better understand the situation of each participant, so in this section, the questions asked were basic, including age, date of birth, gender, and average income (**Table 3**).

To calculate the value of the water bill of a typical family of four in São Paulo, we use the formula below and the table of values charged per cubic meter of water and adding up to 90 % of the amount that is charged on top of the fee for the sewer. In the equation above, the number 4 represents the number of people living in the house; 169.8 liters is the average amount of water used per person per day in São Paulo; 30 is the number of days, and 1000 is used to transform the value into liters for cubic meters.

So, the 20.38 cubic meters of water used by the family corresponds to R$ 25.02 (R$ 22.08 plus R$ 2.94). The total amount is the sum of this amount plus 90 percent of the sewage fee, so the total amount is R$ 47.54.

Questions	Answers (average)
What is your age?	Average: 27 years old
What gender do you identify as?	Female: 41% Male: 59%
Do you live in an urban, suburban, or rural area?	Urban: 89 % Suburban: 6% Rural: 5%
How many people live in your house?	Average: 4 people
What is your median financial income (monthly)?	Average: 2,260 Brazilian reais (approximately to 410.9 American dollar)
You identify yourself as poor, middle class, or rich?	Poor: 29% Middle class: 58% Rich: 0%

Table 3: Survey questions related to demographic information.

Demographic Characteristics of Participants

The average age of the 100 participants was 27 years old. There were more male participants (59%) than female participants (41%). All participants had an average or above-average monthly income, with 74% of participants having an average financial income and 26% having an above-average income. Furthermore, the average number of people living in the same house is four.

We also used official data from Sabesp (Basic Sanitation Company of the state of São Paulo) to measure the impacts of waste on the city's reservoirs (9). We did this by comparing the data, of Sabest before and after quarantine.

ACKNOWLEDGMENTS

We would like to thank the Journal Emerging Investigators team for making this research possible.

Received: November 1, 2021
Accepted: February 15, 2022
Published: June 3, 2022

REFERENCES

1. "Water Facts." *Worldwide Water Supply*. www.usbr.gov-/mp/arwec/water-facts-ww-water-sup.html. Accessed 4 Sep. 2021.
2. "Water Scarcity." *World Wildlife Fund*. www.worldwildlife.org/threats/water-scarcity. Accessed 4 Sep. 2021.
3. "Water waste in Brazil alarming" *Agencia Brasil.* www.agenciabrasil.ebc.com.br/en/geral/noticia/2015-07/water-waste-brazil-alarming. Accessed 6 Sep. 2021.
4. "Water". *United Nations*. www.un.org/en/global-issues/water. Accessed 8 Sep. 2021.
5. "Which Country Showers the Most" *Mirashowers* www.mirashowers.co.uk/blog/trends/which-country-showers-the-most /#:~:text=According%20to%20research%20conducted%20by,the%20world%20sits%20at%20five. Accessed 8 Feb 2022.
6. "Greater São Paulo population reduces water consumption by 15%." *Akatu*. www.akatu-org-br.translate.goog/populacao-da-grande-sao-paulo-reduz-o-consumo-de-agua-em-15/?_x_tr_sl=pt&_x_tr_tl=en&_x_tr_hl=en-US&_x_tr_pto=nui. Accessed 8 Sep. 2021.
7. "Energy Saving Trust at Home with Water". *Energy Saving Trust* www.energysavingtrust.org.uk/sites/default/files/reports/AtHomewithWater%287%29.pdf. Accessed 8 Sep. 2021.
8. "Water Consumption of Pressure Washers." *Contractor Supply*. www.contractorssupplyllc.com/pressure-washer-usage/. Accessed 8 Sep 2021.
9. "Heather Cooley. How the Coronavirus Pandemic is

Affecting Water Demand". *Pacific Institute*. www.pacinst.org/how-the-coronavirus-pandemic-is-affecting-water-demand/
10. "Situação Mananciais." *Sabesp*. www.mananciais.sabesp.com.br/Situacao. Accessed 8 Sep. 2021.