

Comparative Analysis of Water Usage in Domestic Activities: Evidence from Households in Lahore

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ARTICLE INFO	ABSTRACT
Article History: Received: May 20, 2025 Revised: July 07, 2025 Accepted: July 24, 2025 Available Online: August 08, 2025	With the growing imbalance in our environmental systems, water consumption has become one of the most pressing and significant issues of our time. As climate patterns shift and natural resources dwindle, freshwater availability becomes increasingly scarce. This poses a serious threat—not only to ecosystems and agriculture, but to the basic survival of future generations. If current consumption trends continue unchecked, we may soon face a reality where clean water is no longer a readily available resource. This growing crisis calls for immediate action at every level—global, national, and, most importantly, individual. Water-efficient technologies and conservation strategies must be prioritized in both the industrial and commercial sectors, as well as within our homes and in everyday routines. Each one of us, as responsible citizens, needs to rethink the way we consume water. Conservation must begin with awareness, followed by conscious action. In the context of residential use, daily activities such as bathing, doing laundry, dishwashing, and other kitchen tasks account for the majority of household water consumption. Often, we overlook how small habits—like leaving taps running or using outdated fixtures—contribute to significant water loss over time. This paper focuses on analyzing water consumption patterns in residential properties up to 10 marlas in size. It categorizes key water-intensive activities and evaluates them through a comparative analysis of water fixtures, behaviors, and usage habits. The objective is to identify where meaningful improvements can be made on a personal scale—changes that, when adopted widely, can have a lasting and collective impact. By drawing on the findings of this comparative study, the paper outlines practical recommendations and behavioral shifts aimed at fostering a culture of responsible water use. These insights are intended not only to inform, but to inspire individuals to take proactive steps in their homes, thereby contributing to the larger goal of environmental sustainability and water security for future generations.
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Introduction

Water is a fundamental source and a basic necessity for survival. We as humans need to realize that with the city's increasing population and urban growth, we are not far from the day when we will be waiting for water for days. Lahore, with a population of more than 11 million people, is a fast-expanding urban center that owes its location and its very existence to the River Ravi. In Lahore, domestic water consumption is the main use of groundwater, and most of the groundwater is extracted and utilized solely for this purpose within its urban limits. (Malik et al., 2017).

As mindful citizens and humans, we need to look into our daily routines with a more thoughtful approach and try to do our part for our future as well. Increased consumption by the privileged class puts additional strain on this depleting natural resource. (Devi et al. 2022). With the increasing demand, which includes our daily household activities such as bathing, cooking, washing, laundry, and gardening, includes significant amounts of water usage. Understanding how water is used within our homes is essential to designing water conservation strategies.

Problem Statement

An operational definition of water demand management with five components proposed is as follows; (i) reducing the quantity or quality of water required to accomplish a specific task; (ii) adjusting the nature of the task so it can be accomplished with less water or lower quality water; (iii) reducing losses in movement from source through use to disposal; (iv) shifting time of use to off-peak periods; and (v) increasing the ability of the system to operate during droughts. (Bhatti & Nasu, 2019). By the end of the year 2050, more water will be required to produce food to meet the demand of the Earth's population as demand increases to 9 billion (Hassan et al., 2020). Despite global efforts to encourage water conservation, many households lack the awareness and impactful measures to reduce their consumption. In Pakistan, individual behavior of water consumption is excessive because water is almost free for domestic consumption. (Malik, 2022). As a result, water is used inefficiently in areas of Lahore, a city that is still continuously expanding. Without clearly knowing what specific activity or task is consuming water, it would be difficult to make changes and implement effective measures. So, to act upon, the individual role is to first find the root cause of the problem and then work to fix it.

Objective & Scope

This study aims to:

- Identify major household activities and patterns that take up most of the water.
- Comparing the usage-wastage relation with the behavioral way of water consumption.
- Data analysis through a comparative study of fixture differences.
- Conclude from the analysis to suggest the improvements to be made at a personal level.

However, the scope of this study will include residential properties situated in a well-maintained and designed society or town. Including the main activities by using the areas of the toilet, laundry, and kitchen.

Literature Review

Pakistan is one of the 36 most water-stressed countries in the world, withdrawing over 70 percent of total renewable water resources with limited quantities of surface (228 billion cubic meters: BCM) and groundwater about 62 BCM (Habib & Wahaj, 2021). Although water covers 70% of the

Earth's surface, only about 3% is freshwater, and less than 1% is accessible for human use. This small fraction sustains ecosystems, agriculture, and communities. (Howard,2025). Unfortunately, pressures like pollution and over-extraction are depleting this resource faster than it can be replenished. Big cities like Lahore are on top of the list to be affected by water scarcity soon because of the continuous manufacturing and expansion that require an immense number of resources, including water. While these cities might seem flush with water resources, the concentration of people and industry often strains resources, especially groundwater resources. The Lahore High Court (LHC) raised alarms about the falling water levels, highlighting that the situation is leading to drought-like conditions (ANI news, 2025).

Global Trends in Household Water Use

Total domestic water consumption for household uses indicate that the highest amount of water (72%) is used for showers and baths compared to toilet flushing, personal hygiene, and clothes washing (A. Narmilan et. al,2021). Most of the studies conducted showed that domestic use of water is majorly ignored and unmonitored, which results in excessive use of water without even realizing its effect. The 2019 World Economic Forum Global Risk Report describes that the water crises in terms of likelihood and effects are available on the top ten risks. (Foundation, 2021). The statistics of the daily water used on average by individuals in liters in each country are: USA-373, Japan-286.5, China-178, Australia-340, New Zealand-250-300, UK-142, Mexico-5.419, Germany-121, France-150, Belgium-7.406, Brazil-108, Kenya-50, Norway-180, Canada-329, Italy-6,500, Portugal-6,203, Spain-132, Russia-279 and Israel 100-230. You might expect that the country to houses the biggest water consumption daily would be the country to have the largest population, but China, which does have the world's largest population, has a smaller daily water consumption than Belgium (Long, 2022).

Domestic Water Use Patterns in Lahore

Think about an ordinary day—how often do we leave the water running without a second thought? Maybe it's while brushing our teeth, shampooing our hair in the shower, or rinsing dishes in the kitchen. It might not seem like much at the moment, but those extra minutes of running water add up. What feels like a small convenience today could be a serious cost for the future.

The standard daily requirement of water for a person is 50 liters, irrespective of economic status (Mahmood et al., 2021). However, due to industrial activities and open waste disposal into streams and rivers, we have polluted our rivers and underground resources of water resources extremely (Noor, 2024).

This study takes a closer look at three of the most water-intensive household activities: bathing, laundry, and dishwashing. These are part of our everyday routines, yet we rarely stop to consider how much water they use. By focusing on these tasks, the research aims to spark awareness and encourage smarter, more mindful habits at home. Because the truth is, saving water doesn't always require big changes—it often starts with small, intentional steps we can all take in our daily lives.

Methodology

Although there is a lot of research done on the domestic water consumption in households of populated cities, very few studies offer a comparative study of fixtures by activity in developing cities like Lahore. Hence, this study aims to fill the gap of behavioral consumption of water in

various activities and how the available fixtures in the market can be thought from the perspective of water efficiency instead of just aesthetics and style.

Research Design

This study adopts a quantitative and descriptive research design to compare and analyze the usage of the activity. The focus is to measure actual or estimated water usage in liters using the time-to-fill method (Water & Estimates of Water Flow, n.d.) for common domestic tasks and evaluate patterns based on household size, behavior, and appliance use.

Study Area with Activity Categorization: Water Use by Activity & Factors Affecting

This study was conducted in Lahore, a rapidly growing urban area, where water scarcity is continuously increasing. The target audience is people of residential properties of well-planned towns in the city. Covered areas of property being more than 10 marlas and below 1 kanal with no issue of water supply. Activity categorization with fixtures usage as:

Table 1: Areas and activity categorization with different fixtures

Household Area	Activity Type	Common Fixtures / Behavior
Toilets/Bathroom	Sanitation-Use of WC	wash down flush Dual flush
	Hygiene- Use of sink	Running water Closed tap
	Bathing - use of a shower	Shower head Bathtub
Kitchen	Dish washing	Sink - running water Filled sink Dishwasher
Laundry area	Cloth washing	Manual washing Washing machine

A structured questionnaire was shared with the target audience, which showed their behavioral consumption and fixture differences for water use as shown in Table 1.

Data Collection

To know the relationship between water consumption, behavioral usage, and comparison of fixtures, a total of 5 to 8 homes were analyzed to come down with data that represents the majority of people living in that area. Data collected was:

- The flow rate of taps and showers was calculated using the time-to-fill method.
- Covered area and number of inhabitants.
- Habitual usage of water while doing laundry, dishwashing, and sanitation.
- Details of fixtures used for the activities.

Table 2: Data collected from the questionnaire

Home	Area	No. Of people	Laundry (Washing Machine)	Kitchen	WC	Bathing
H1	4500 Sq.ft.	7	Daily	Filled sink	Single flush	Shower head
H2	2750 sq.ft.	4	Once a week	Filled sink	Traditional WC	Shower head
H3	5000 sq.ft.	7	Daily	Running tap	Single flush	Bathtub
H4	3812 sq.ft.	5	Daily	Dishwasher	Single flush	Bathtub
H5	2730 sq.ft.	4	Twice a week	Running tap	Single flush	Shower head
H6	2750 sq.ft.	5	Thrice a week	Running tap	Dual flush	Shower head
H7	3820 sq.ft.	7	Once a week	Running tap	Dual flush	Shower head

Running tap: meaning the tap is continuously on, even when not in use, like while rubbing soap on plates.

Filled sink: meaning the sink is only half filled to wash the dishes, and the tap is only used to rinse the soap off at the end.

Single flush: uses the same amount of water irrespective of the waste.

Dual flush: uses less amount of water for liquid waste and more for solid waste. It's also pressure sensitive- the button pressed for a long time takes more water to flush.

Traditional WC: flushed with whatever amount of water is filled in the tank behind.

Moreover, in kitchen use, the average of water used per minute through the time-to-fill method was **5 liters per minute**.

Based on the data collected, visual charts were developed to illustrate the percentage distribution of water consumption across various household activities and fixtures. These visualizations help to identify how different methods, such as manual versus automated washing, or traditional versus water-efficient fixtures, contribute to overall water usage, allowing for a more comprehensive understanding of consumption patterns and areas where improvement is most needed. The visuals of each activity with the fixtures used are shown below.

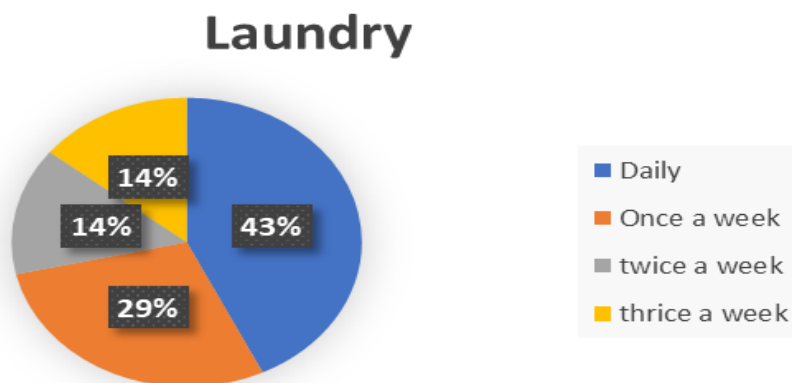


Figure 1: Percentage of people doing laundry using the washing machine

Figure 1 shows that the majority of people chose to do laundry daily, and everyone used a washing machine to do the activity instead of doing it manually. Because no matter how many clothes need to be washed, the washing machine is filled with the same amount of water to wash the clothes.

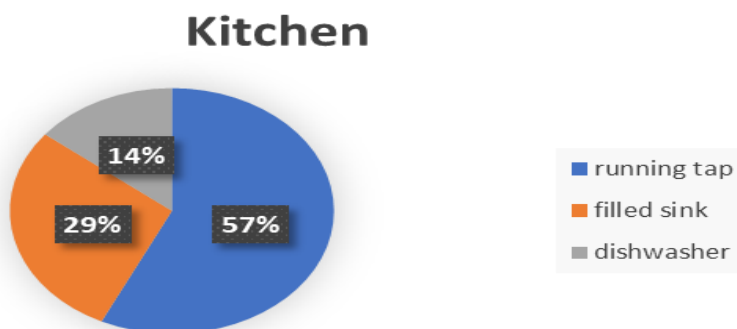


Figure 2: Habitual way of dishwashing in percentages

Figure 2 shows the habitual use of water during the activity of washing dishes. Seen that the majority of the people kept the tap running throughout, even when the water is not being used, which further affects the water consumption.

Next, for the toilet activity, the shower head, bathtub, and flushing system data were collected as:

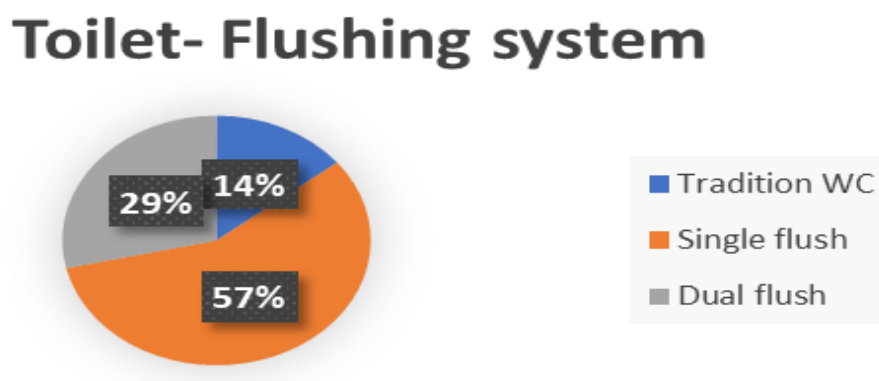


Figure 3: Percentage of flushing system types used

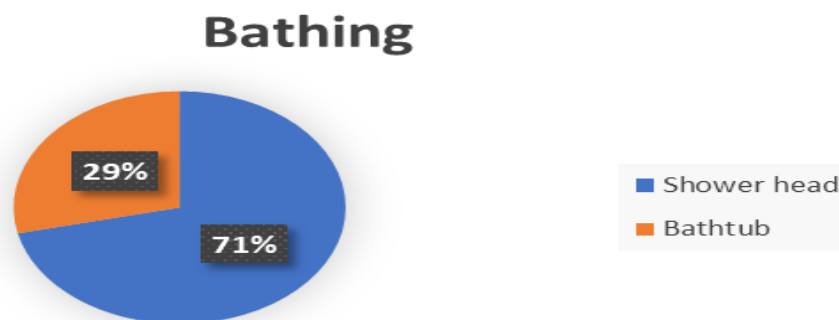


Figure 4: Bathing fixture used in bathrooms

The figures highlight the percentage of residents, their water-use habits, and the types of fixtures commonly used across various household activities, particularly among people living in well-maintained communities where water scarcity is not yet a concern.

Moving forward, the collected data will now be used to see how these habitual and fixture differences are adding up to the water efficiency of the majority of these households.

Observations

From the collected data, now by closely observing and knowing the water per minute use, we will go forward to analyze how much variation exists in water quantity through these variables. By linking the usage percentages with actual water consumption figures for each activity, we can begin to observe the significant disparities in water usage. This comparison reveals not only the impact of user habits and fixture type but also highlights where the greatest potential for water conservation lies. By gradually exploring each activity through quantitative analysis, use as follows:

Laundry: For this activity, the majority of the target audience used a washing machine daily for washing clothes, as shown in Figure 1. Also, from the manual data of these machines was seen that the standard top load machines use approximately 13 liters/ kg and as most of the households in our target audience use 8 to 12 kg washing machines. This gives us the average data that a washing machine uses **130 liters of water per wash**, irrespective of the amount of clothes. Now, if we apply this quantitative data to the data collected earlier, we see that:

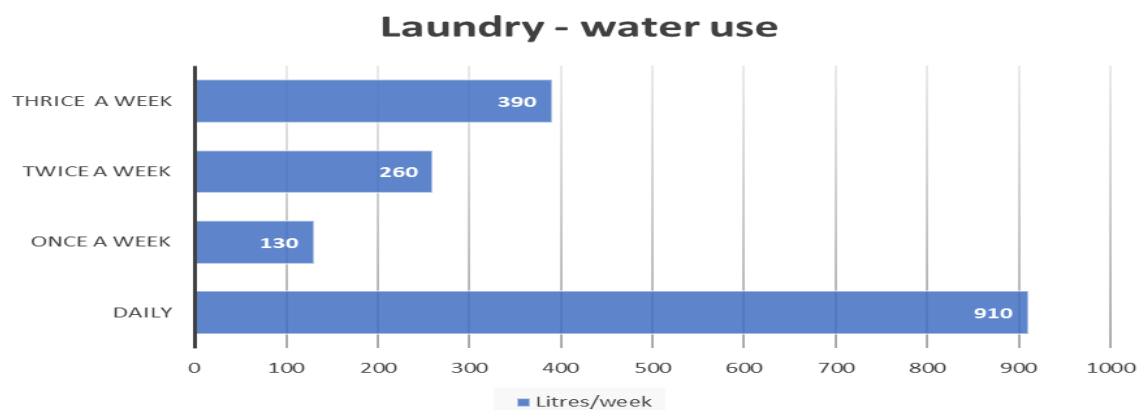


Figure 5: Liters of water used per week

As shown in Figure 5, we can see the clear difference between the amount of water used by the people who do laundry daily, as compared to the people who choose to do laundry once or twice during the week.

From the data collected, we also observed that most of the people choose to do laundry just because they don't want to do it all at once, as it takes more time. However, if we look at it from the water efficiency perspective, we know that doing laundry only when the basket is full is always better than not wasting water.

Kitchen: During dishwashing, we used a time-to-fill method and found that a running tap uses **5 liters of water per minute**.

Normally, washing the dishes with a **running tap** for a family of 7, took approximately **6 minutes and 18 seconds**, out of which only **1 min 45 seconds** was determined to be the actual use of water. Doing the calculation, it showed that this habitual use of water for this activity used approximately **31 liters of water**.

With the filled sink, we observed that it took **3 minutes** to fill the sink and afterwards, **1 minute** to rinse the soap off the dishes. Hence, this habitual way uses 4 minutes, which means **20 liters of water**.

With the dishwasher, looking into the specifications of the used product, it showed that it only uses **9-10 liters of water** per cycle, and one cycle is enough to wash perfectly.

The three ways are shown below:



Figure 6: Three ways of water usage/consumption during dishwashing in kitchen

Images above show the habitual ways and fixtures used by the majority of the target audience for dishwashing. Three ways of dishwashing as a filled sink, a running tap, and a dishwasher for this activity use water capacity differently. However, the comparison of the water utilization of the 3 ways used for dishwashing purposes is shown in the figure below:

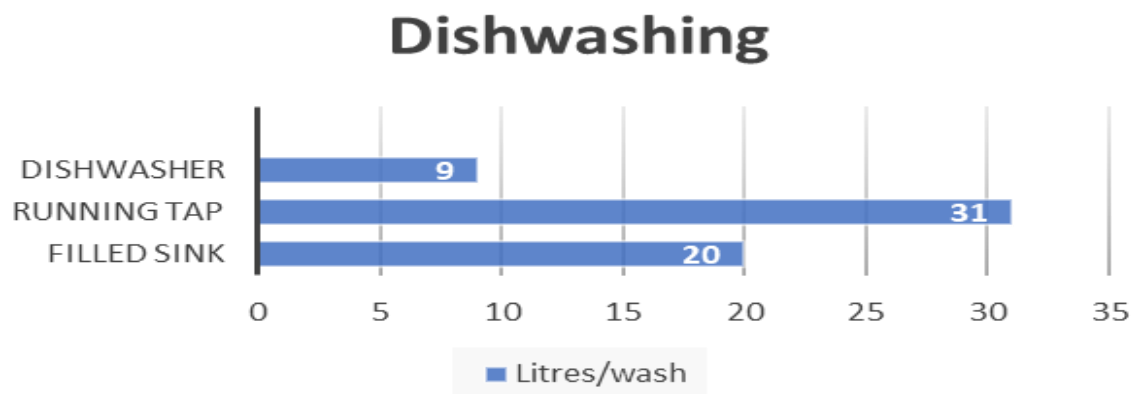


Figure 7: Amount of water used per wash

As shown in the figure, it is clear which way of habitual use takes more water and which is the most efficient way of using the water for dishwashing. As responsible and thoughtful humans for our well-being, we should use the available sources that promote more water saving in this activity.

Toilet & Bathing: In the target audience, the two ways to bathe were using Shower heads or bathtubs. From observations, it was found that an average shower head uses **3- 4 liters of water per minute**. However, a standard bathtub uses **250-300 liters of water**. Considering that usually a person takes 10- 15 minutes to take a bath, but for this same activity, the two fixtures shown below use a capacity of water differently.

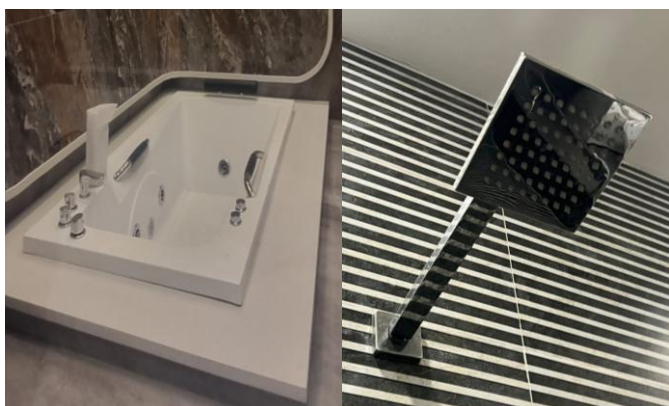


Figure 8: Showing the images of water usage/consumption during bathing activity in bath tub and in shower

As shown above in the images, the activity of bathing by the majority in Lahore is done by the use of these two fixtures. However, the quantity of water used by each is:

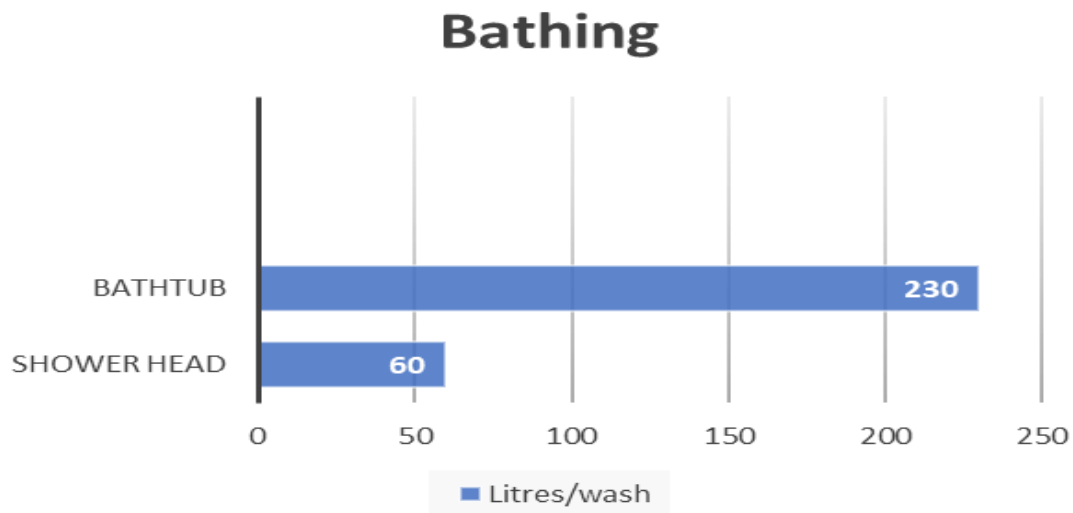


Figure 9: Amount of water used per wash

As shown in Figure 9, it is evident that in the given set of time, shower heads use less amount of water as compared to Bathtubs, as without considering the time a bathtub will take same amount of water results in more wastage.

Moving forward for toilet use, the three fixtures found were Traditional WC (water-filled tank attached to seat), single flush, and dual flush WC, with images below, and the mechanism explained earlier.



Figure 10: Showing the images of flushing systems of water through different ways.

As shown in the images above, the three types of flushing systems use different amounts of water depending on the capacity of the tank, the air pressure mechanism, and in the case of dual flush it depends on the type of waste whether liquid or solid, the pressure applied on the button which changes the time of water coming out. Hence, the water used by each is considered by looking into the general specifications of WCs used in Lahore. Traditional WC uses 10-13 liters of water per flush. Single flush uses 6-7 liters per flush (*Conserve Water At Home*, n.d.), dual flush with pressure button uses only 3.5 liters of water. The water usage comparison is shown below:

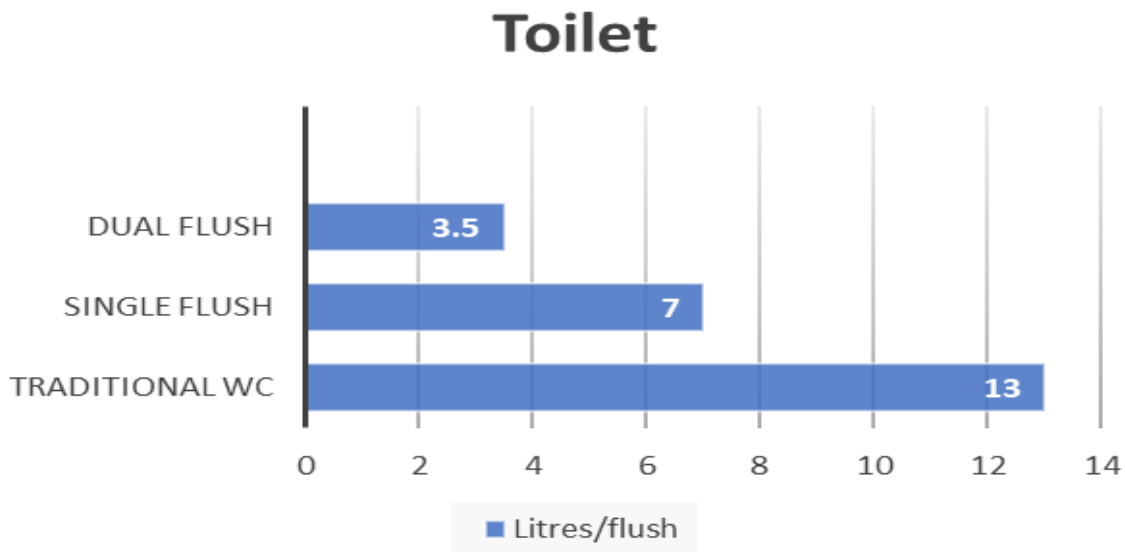


Figure 11: Amount of water used per flush

As shown in the figure above, the most efficient flushing system for toilets is a dual flush WC as it uses the least amount of water compared to the other. A dual flush WC uses two buttons, one for liquid waste and the second for solid waste, with the additional pressure feature (the longer you press the button, the more water runs out), which means that conscious use can further decrease the consumption.

Comparison of Data

The three activities studied and observed under the lens of water consumption by habitual use and fixture differences were analyzed by quantitative and observational methods. Moving forward, we will compare the visualized data found and explore the most water-efficient way of doing these activities. Comparison of each activity combined with the water usage in quantity by both habitual and fixture differences. The comparison of the data is shown in the figure below:

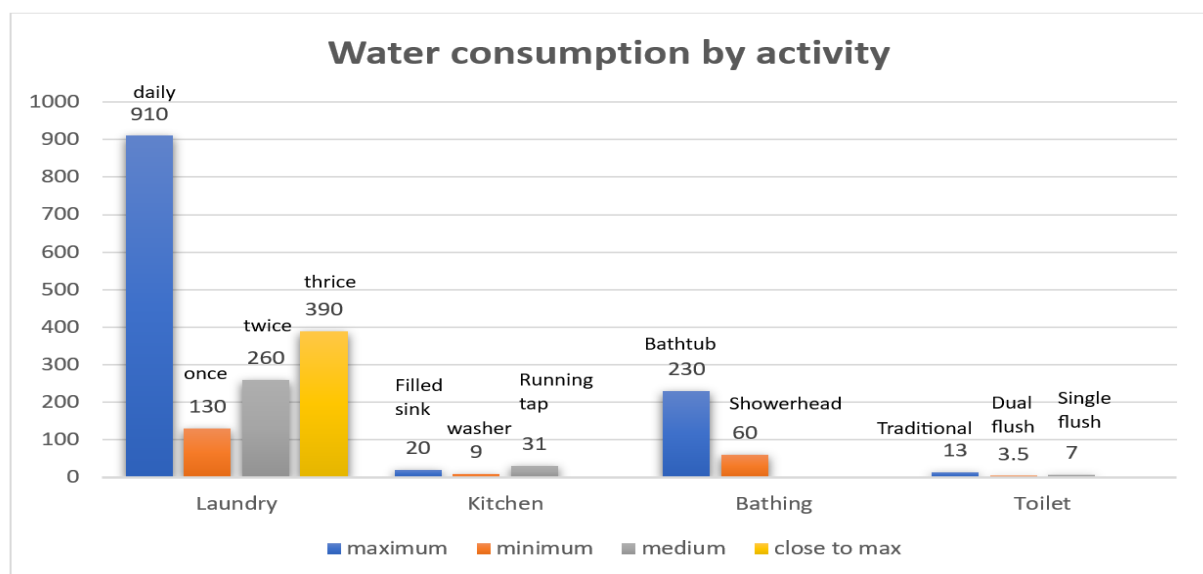


Figure 12: Comparison of water usage by each activity

The above figure clearly shows the comparison between the usage of water, either its habitual or fixture variation in the consumption. For each activity, the quantity of water in liters shows the maximum and minimum amount of water. The above data collected can lead to an efficient way of using water now, which can play a role in delaying the upcoming scarcity and preventing danger ahead.

Results

The comparative analysis shows a clear distinction between the household water usage patterns based on fixture type and user behavior. For instance:

- Laundry done every week showed the most consumption of water as compared to once a week. From 910 liters to 130 liters per week, there is a huge gap that can be covered, as the lowest usage is also possible. This difference could save 780 liters per week.
- For dishwashing, although the affordability of dishwashing is not possible for everyone but considering the target audience of this research, it is possible for the individuals to afford, considering the water consumption difference of running a tap (31 liters) to a dishwasher (9 liters), which could save 22 liters of water per wash.
- Bathing is mostly done every day, but for less water consumption shower head is more efficient as it uses only 60 liters of water as compared to a bathtub, which uses 4 times more water.
- For the toilet, the mechanism of flushing system mechanism used makes a difference in water consumed, as the latest fixtures available in the market with pressure assistance and less water capacity offer the use of 3-4 liters of water instead of 13 liters of water used by a traditional WC, saving 9 liters of water.

These findings from the data collected give a clear view and relation between the habitual use and fixture types with the overall water efficiency.

Ethical Considerations

As responsible citizens and individuals, in light of the conditions of our environment, we need to take the matter into our hands by consciously and thoughtfully using the water source. By a more serious intake and consumption, we can save the dying source for our betterment and future generations. Just a thought of our life without water will make an individual think about the number of days left on earth.

Some 700 million people could be displaced by intense water scarcity by 2030.

By 2040, roughly one in four children worldwide will be living in areas of extremely high-water stress (UNICEF, n.d.). Hence, the improvements made at the domestic level can have a slight impact on the upcoming situation.

Discussion

The results highlight how domestic water consumption is shaped by the choice of fixtures used and habitual or behavioral use. High-consumption patterns such as daily laundry, dishwashing with running tap, use of the bathtub, and traditional WC due to convenience, even with the awareness of water conditions, affect the total consumption a lot. The data indicates that even with moderately efficient fixtures, the habitual behavior can lead to excessive water use.

For example, dishwashers are more efficient, but less common because of the habit and cost to some extent. Similarly, the laundry done daily instead of collecting clothes through the week is only because of the resistance to doing more work altogether. These patterns indicate the lack of awareness and concern, behavioral impact, and ignorance of the matter. With the improvements in household infrastructure and behavioral interventions, a much-needed difference can take place that can play a huge role in saving the resource, the earth, and the environmental cycle.

Conclusion

This comparative study reveals that significant reductions in water usage can be made by small behavioral changes and the adoption of water-efficient fixtures. Activities of daily life, such as bathing, toilet flushing, laundry, and dishwashing, can account for a large proportion of water conservation at a domestic level.

The findings indicate that simple awareness combined with thoughtful interventions and upgrades can significantly reduce the consumption. As said, “If we put a value on nature, then we will measure it. If we measure it, we can manage it. If we manage the value, we avoid destroying it.” (*Elliott Harris: Measure the Value of Nature – before It’s Too Late*, 2021). Hence, we need to understand the value of this source before it gets out of our reach.

We need to understand the impacts of this problem. Apart from the basic human need, this can also become a more impactful problem before it even reaches its natural lifespan. Taking an example of a country-scale impact by recalling how Israel restricted water access during conflicts in Gaza, this is a clear example of how water shortage can be weaponized. According to UN Chief Antonio Guterres, the global challenge of water scarcity is further compounded by the lack of cooperation agreements among countries sharing water resources. While 153 countries share water resources, only 24 have signed cooperation agreements covering all of their shared water, highlighting a critical gap in international cooperation. (Siddiqui, 2024). The Water and Sanitation Agency (WASA) of Lahore, Pakistan, supplies water to 5.29 million people through 598 tube wells but faces difficulties in meeting rapidly increasing water demand, lowering groundwater table, high energy costs, and low water tariffs. However, the actual water consumption and water loss have never been estimated due to water meter outages. (Abbas et al., 2022). Given the conditions of Lahore, where the population and urban fabric are continuously increasing at a rapid pace, the time frame is also getting shorter. The loss of this resource is not far off if we keep on ignoring its importance and value.

Implications for Policy and Urban Planning

The findings of this study, alongside personal improvements, also direct us to the implications in policy development, especially in water-stressed regions like Lahore.

The rising issue has somehow made an impact, like: As per Honorable Lahore High Court direction, water violation will be revised as 10000/- for car/ramp washing by pipe domestically. (*Revision of Water Violation Challans (Domestic)* | WASA, Lahore, n.d.). Also, WASA Director Mudassar Javed took the initiative of green taps to prevent water wastage during ablution in mosques. (*Wasa Launches Green Taps Initiative to Save Water*, 2024). In collaboration with the Japan International Cooperation Agency (JICA), WASA Lahore rehabilitated 105 aging tube wells. This initiative aimed to restore production capacity and improve energy efficiency, thereby ensuring a stable and sustainable water supply. (Gull, 2025). Moreover, as a result of the collaborative efforts between WWF and the Coca-Cola Foundation, progress is being made in

promoting responsible water usage, fostering community involvement, and preserving the natural environment. This field visit to the Ravi River serves as a testament to the commitment of both organizations towards creating a sustainable and water-secure future for Lahore. (*Sustainable Water Management for Lahore*, 2023).

However, these initiatives are good in terms of thinking about the rising issue on a larger scale, but there are some other implications as well that need to be considered. The findings of this study have implications for policy development and urban planning at the domestic level, like:

- **Incentivize water-efficient fixtures:** The Government should provide subsidies for dual flush toilets, low-flow showerheads, dishwashers, and limited water use for laundry in both new and older constructions.
- **Public Awareness Campaigns:** promoting and working on more initiatives that educate more residents on water-saving behaviors and the impact of change, like turning the taps off while brushing or washing dishes and doing laundry only when the basket is full.
- **Mandatory Water Audits and Metering:** Implementing smart water metering and usage disclosure in households can increase accountability and promote reduced consumption.
- **Revised Building Codes:** Urban planning authorities should strictly mandate water efficiency standards in housing codes, especially in newly developing societies.
- **Imposing Laws at Micro Scale:** Societies should impose laws for residents, like restricting car washes and parking area washes. Imposing laws and fines for water wastage can increase the chances of residents being more serious and critical about the problem.

Integrating these strategies can not only alleviate pressure on Lahore's groundwater resources but also set a precedent for sustainable urban living in cities facing a similar issue.

References

1. Devi, K., Singh, M., Kumar, P., & Kumar, Y. (2022). Household domestic water consumption patterns in a rural semi-arid village: A case study of Kumbha village in Hisar district, Haryana. *International Journal of Geography, Geology and Environment*, 4(2), 01–05. <https://doi.org/10.22271/27067483.2022.v4.i2a.105>
2. Malik, A. O. (2022). Water consumption behavior of households in Lahore. *Governance and Society Review*, 1(1). <https://doi.org/10.32350/gsr.11.01>
3. Howard, M. (2025, January 16). Water scarcity. Worldlife, Org. Retrieved May 8, 2025, from <https://www.worldwildlife.org/stories/water-scarcity-8-facts-you-need-to-know>
4. Narmilan1,*, N. Puvanitha2 , G. Niroash1 , M. Sugirtharan3 , R. Vassanthini1, A. N., *, N. Puvanitha2 , G. Niroash1 , M. Sugirtharan3 , R. Vassanthini1. (2021). domestic water use patterns in house household. In Scispace. <https://scispace.com/pdf/domestic-water-consumption-pattern-and-awareness-of-urban-ii3fcmo702.pdf>
5. Malik, N., Aboidullah, M., & Chaudhry, M. N. (2017). Report Title. In pu.edu.pk. https://pu.edu.pk/images/journal/studies/PDF-FILES/Article%2012_v17_2_dec17.pdf
6. Long, E. (2022). An Introduction to Global Water Wastage. <https://eponline.com/articles/2022/08/11/global-water-wastage.aspx>
7. Foundation, W. B. M. (2021, December 30). Importance of Water in People's Life. <https://wbmfoundation.org/importance-of-water-in-people-life/>
8. Bhatti, A. M., & Nasu, S. (2019). Report Title. In www.ssms.jp. https://ssms.jp/img/files/2019/04/sms10_183.pdf
9. Hassan, Z., Elahi, M., & Ullah, H. (2020). *_DETERMINATION_OF_DAILY_WATER_CONSUMPTION_PATTERN_A_CASE_S*

- TUDY_OF_KHYBER_PUKHTOONKHWA_PAKISTAN.
<https://www.researchgate.net/publication/345389494>
10. Habib, Z., & Wahaj, R. (2021). Water availability, use, and challenges in Pakistan. <https://openknowledge.fao.org/server/api/core/bitstreams/32a52de0-7299-4bb7-a889-9d97e913170a/content>
 11. WATER 3. ESTIMATES OF WATER FLOW. (n.d.). Retrieved May 15, 2025, from https://www.fao.org/fishery/docs/CDrom/FAO_Training/FAO_Training/General/x6705e/!17521!x6705e03.htm
 12. ANI news, A. (2025). Pakistan: Lahore HC raises alarm over water crisis, proposes “emergency.” ANI news. <https://www.aninews.in/news/world/asia/pakistan-lahore-hc-raises-alarm-over-water-crisis-proposes-emergency20250329201138/>
 13. Noor, H. (2024). State of Lahore’s Drinking Water Supply. <https://www.envpk.com/state-of-lahores-drinking-water-supply/>
 14. Conserve Water At Home. (n.d.). <https://www.plt.org/family-activity/conserve-water/>
 15. (UNICEF.n.d n.d., n.d.). <https://www.unicef.org/wash/water-scarcity>
 16. Elliott Harris: Measure the value of nature – before it’s too late. (2021). <https://www.un.org/en/climatechange/elliott-harris-measure-value-nature>
 17. Siddiqui, S. (2024). Individual efforts in water conservation. <https://pakobserver.net/individual-efforts-in-water-conservation/>
 18. Abbas, muzzaffar, kazama, shinobu, & takawaza, satoshi. (2022, July 22). Water Demand Estimation in Service Areas with Limited Numbers of Customer Meters—Case Study in Water and Sanitation Agency (WASA) Lahore, Pakistan. Mdpi. <https://www.mdpi.com/2073-4441/14/14/2197>
 19. Revision of Water Violation Challans (Domestic) | WASA, Lahore. (n.d.). Retrieved May 21, 2025, from <https://wasa.punjab.gov.pk/node/67>
 20. Wasa launches green taps initiative to save water. (2024, August 10). <https://www.thenews.com.pk/print/1218351-wasa-launches-green-taps-initiative-to-save-water>
 21. Gull, D. E. (2025, March 1). Project Story - Capacity Building of Water and Sanitation Agency (WASA) Lahore. <https://www.linkedin.com/pulse/project-story-capacity-building-water-sanitation-authority-pe-bbkvf/>
 22. Sustainable water management for Lahore. (2023, August 20). <https://www.nation.com.pk/20-Aug-2023/sustainable-water-management-for-lahore>