

# A Comparative Study of Household Water, Sanitation and Hygiene (WASH) Covariates Across Socioeconomic Strata



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## Abstract

**Background:** Water, sanitation, and hygiene (WASH) are essential for a healthy and productive life. High-quality access to these services reduces disease occurrence and spread in communities. Developing countries, including Pakistan, face significant challenges in providing these facilities. This study aims to highlight WASH-related service disparities in Pakistani households based on socioeconomic strata.

**Methodology:** A stratified random sampling strategy was used, with a sample size of 1200 households based on the PDHS 2019 special survey. Descriptive analysis and chi-square tests were conducted to assess the association between wealth quintiles and WASH access.

**Results:** The study found that 82.4% of households had access to improved sources of drinking water. Only 4.8% of households in the lowest quintile had access to improved drinking water sources. Water unavailability for at least one day per week was 13% higher among the lower quintiles. Forty-four percent of households using improved sanitation facilities belonged to the two highest strata, while poorer households predominantly used unimproved sanitation facilities.

**Conclusion:** Lower-quality WASH access is more prevalent among lower wealth quintiles, increasing the risk of disease and infection. Further research is needed to inform policymakers and develop plans to reduce inequalities in access to WASH services. **Keywords:** Water and sanitation, hygiene, Pakistan Demographic and Health Survey, inequalities, wealth quintiles

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## Introduction

A condition that is essential for leading a healthy and productive life is having access to water, sanitation, and hygiene facilities. WASH is a fundamental human right that is required for many basic needs of people. It covers important demands such as dignity, productivity, and happiness as well as more fundamental demands such as nutrition, excretion, and safety. It is also essential for ensuring a high degree of children's survival in their early years and keeping the infant mortality rate (IMR) of a population in check (1).

In 2017, a sizable proportion of the worldwide population had access to safe drinking water. Approximately 71% of the global population (5.3 billion people) had reliable and uncontaminated drinking water (2). In contrast, only 45% of the population, or approximately 3.4 billion people, had access to proper sanitation. Notably, for appropriate wastewater treatment, 31% (2.4 billion people) used private sanitation connected to sewage networks (3). However, the distribution of these facilities is in no way equitable, as only 40 out of 152 nations are expected to

achieve universal basic sanitation by 2030 (2).

The availability of WASH services is not universal and varies greatly depending on factors such as nation, region, geography, and rural or urban settings (4). This inequality in access is particularly prominent among urban people, particularly those living in slum regions. According to the United Nations, more than 90% of urban expansion occurs in the developing world, where a sizable majority of the urban population still lives (5). A survey of slum inhabitants revealed poor physical and environmental conditions, as well as limited access to vital services such as water and sanitation. Most of the investigated slums lack facilities and showers, which is especially troubling for women (6).

Persistent gaps in WASH access remain across several other dimensions, e.g., inequities between rich and disadvantaged persons and gender-related inequalities. Sub-Saharan Africa and South Asia have substantial populations that lack basic hygiene amenities, such as soap and water handwashing stations. In South Asia, more than half of the rural population, or 640 million people, lack access to handwashing facilities. Due to limited resources and environmental stress, the region is

confronted with significant problems related to satisfying increasing needs for water, food, and energy. The distribution of resources among such large populations also creates a challenge. In India, from 1995 to 2008, the wealthiest 40% of citizens received more than two-thirds of sanitation improvements, leaving only 3% for the poorest quintile (7).

Despite significant gains in recent years in attaining WASH services, water quality management and wastewater management remain issues in the WHO Southeast Asia Region. The failure of certain regional authorities' monitoring and tracking measures to address these worries is a contributing factor (8).

Pakistan is facing enormous issues related to providing clean drinking water to its population. It ranks among the top ten countries in terms of the proportion of people who lack a reliable supply of clean water to consume. Hand pumps and groundwater are the major sources of drinking water for more than half of village families, whereas irrigation canals are the predominant source in places with saline groundwater. Disparities in the provision of potable water exist among provinces. For example, in Khyber Pakhtunkhwa (KP), 35% of the population uses tap water as their major drinking water source, compared to 18% in Punjab (9).

The literature above shows that there are several challenges that exist in the WASH sector, especially on the developing side of the world. Reducing inequalities is a major focus of today's health policies and requires extensive data to act upon and timely planning to mitigate them.

The present study aims to highlight various WASH-related service disparities that exist in Pakistani households on the basis of socioeconomic strata. Information on the current topic, in this setting, is scarce and would need elaboration to allow policy makers and front-line workers to tackle the issues in a systemic way. Having a better understanding of the situation between provinces and at the urban/rural level would help policymakers properly allocate resources and address these issues

## Methodology

This study employed a retrospective analysis of secondary data obtained from the Pakistan Maternal Mortality Survey (PMMS) 2018–19, a component of the Pakistan Demographic and Health Survey (PDHS) program. The PMMS is a specialized survey focusing on maternal mortality and its determinants, conducted periodically to provide comprehensive insights into maternal health outcomes in Pakistan. The PDHS is a nationally representative cross-sectional survey conducted by the National Institute of Population Studies (NIPS), in collaboration with ICF International and sponsored by the US Agency for International Development (USAID). The survey encompasses all provinces of Pakistan, including the Merged Areas, Gilgit Baltistan, and Azad Jammu and Kashmir, ensuring broad coverage of the country's demographic and health indicators.

Data collection for the PDHS was conducted using a stratified cluster sampling method. This approach involved dividing Pakistan into strata based on geographical regions and urban-rural classification. Clusters were then selected

from each stratum using probability sampling techniques, ensuring proportional representation of different regions and population groups. The unit of analysis for this research was households, and the dataset utilized was the PDHS Household Survey dataset (PKHH7ASV). This dataset included detailed information on demographic characteristics of residents, wealth quintile of home clusters, availability of domestic facilities, and other relevant variables on a household level.

We used specific variables pertaining to WASH from the dataset to assess the quality and quantity of access to these necessities at the household level. The specific variables utilized included the following:

- a) Descriptive variables: Gender, marital status, region of residence, and type of residence.
- b) Water access-related variables included the main source of drinking water, location of source of water, water unavailability for 1 day/week, and clean water access.
- c) Sanitation variables: Toilet facility, location of toilet facility, sharing of facility with other households, separate kitchen.

The wealth index was used as the independent variable and consisted of 5 categories: lowest, second, middle, fourth and highest. It acts as a composite measure of a household's cumulative living standard. All variables were analysed based on the 5 economic strata, and conclusions were drawn. During analysis, adjacent quintiles have been presented as a merger in certain areas as 'Poorer' and 'Richer' strata to provide an overall clear picture. This technique has also been used in other studies and has been discussed with DHS experts (10).

A stratified random sampling strategy was utilized due to the large number of missing values in the dataset, which offers a secondhand solution to drawing valid inferences from data without the expense of introducing bias into the system. A total of 1200 samples were drawn randomly from the set, based on 6 regions of the country considered individual strata, and analysis was performed.

All the data were entered and analysed in SPSS version 25. For the qualitative variables, descriptive analysis was performed, and the data are presented as frequencies and percentages. For the quantitative variables, the chi-square test ( $\chi^2$ ) was used to check associations between WASH variables and the five wealth quintiles of lowest, second, middle, fourth, and highest. The level of significance was set as 5%, and the associated p values are reported.

## Results

Descriptive analysis of the variables showcases a greater percentage of women in the sample, by a very slight margin of 4.7%, while the households are equally divided between the urban and rural populations.

Regarding drinking water sources, we find that although 82.4% of households have access to improved sources (the improved sources of water are listed in Fig. 1), 91.7% of the water sources are not considered clean. The majority of people use relatively unclean water for daily use, which can be a source of disease. A little above 50% of the households' water sources are located in their own dwelling, but a significant number of people (36.2%) have to access

these sources outside of their homes, limiting their control of the quality of the water. Additionally, 1/3rd of the households face water shortages for at least 1 day per week.

Sanitation marks the second challenge in these contexts but shows an overall better picture compared to water. More than 90% of the households use improved sanitation facilities (the improved facilities are explained in Fig. 2), and a similar proportion have their own private latrines, which they do not have to share with neighboring families.

**Table 1. Descriptive analysis of wash variables**

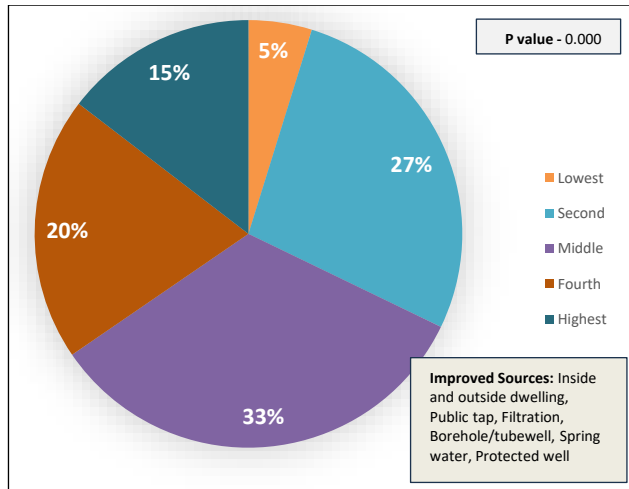
Variables	Freq. (n)	%
<b>Gender</b>		
Male	572	47.7
Female	628	52.3
<b>Marital status</b>		
Married	640	53.3
Divorced/Separated	52	4.3
Widowed	66	5.5
Unmarried	442	36.8
<b>Region of Residence</b>		
Punjab	200	16.7
Sindh	200	16.7
AJK	200	16.7
Baluchistan	200	16.7
Gilgit Baltistan	200	16.7
KP	200	16.7
<b>Type of residence</b>		
Rural	596	49.7
Urban	604	50.3

**Table 2. Comparison of wealth quintiles**

Variables	Household Wealth Quintiles N (%)					P value
	Lowest	Second	Middle	Fourth	Highest	
<b>Gender</b>						
Male	45 (7.9)	153 (26.7)	157 (27.4)	118 (20.6)	99 (17.3)	0.532
Female	38 (6.1)	158 (325.2)	187 (29.8)	123 (19.6)	122 (19.4)	
<b>Region of residence</b>						
Punjab	20 (10.2)	57 (29.1)	70 (35.7)	30 (15.3)	19 (9.7)	0.000
Sindh	11 (5.5)	34 (17)	21 (10.5)	43 (21.5)	91 (45.5)	
AJK	-	45 (22.5)	37 (18.5)	50 (25)	68 (34)	
Baluchistan	36 (17.6)	65 (31.9)	93 (45.6)	-	10 (4.9)	
Gilgit Baltistan	16 (8)	89 (44.5)	74 (37)	21 (10.5)	-	
KP	-	21 (10.5)	49 (24.5)	97 (48.5)	33 (16.5)	
<b>Type of residence</b>						
Rural	48 (8.1)	238 (39.9)	145 (24.3)	108 (18.1)	57 (9.6)	0.000
Urban	35 (5.8)	73 (12.1)	199 (32.9)	133 (22)	164 (27.2)	
<b>Location of source of water</b>						
In own dwelling	9 (1.4)	124 (19.4)	220 (34.4)	153 (23.9)	133 (20.8)	0.000
In own yard/plot	6 (4.8)	51 (40.5)	38 (30.2)	23 (18.3)	8 (6.3)	
Elsewhere	68 (15.6)	136 (31.3)	86 (19.8)	65 (14.9)	80 (18.4)	
<b>Unavailability of water for one day/week</b>						
Yes	33 (11.1)	93 (31.4)	74 (25)	48 (16.2)	48 (16.2)	0.000
No	50 (5.5)	218 (24.1)	270 (29.9)	193 (21.3)	173 (19.1)	
<b>Clean water</b>						
Yes	-	33 (33)	10 (10)	19 (19)	38 (38)	0.000
No	83 (7.5)	278 (25.3)	334 (30.4)	222 (20.2)	183 (16.6)	
<b>Location of toilet facility</b>						
In own dwelling	53 (5.2)	201 (19.6)	317 (31)	231 (22.6)	221 (21.6)	0.000
In own yard/plot	30 (19.7)	93 (61.2)	19 (12.5)	10 (6.6)	-	
Elsewhere	-	17 (68)	8 (32)	-	-	
<b>Sharing facility with other households</b>						
Yes	7 (6.4)	70 (64.2)	26 (23.9)	6 (5.5)	-	0.000
No	76 (7)	241 (22.2)	314 (28.9)	235 (21.6)	225 (20.3)	
<b>Separate kitchen</b>						
Yes	50 (5.8)	209 (24.4)	217 (25.4)	185 (21.6)	194 (22.7)	0.000
No	33 (9.6)	102 (29.6)	127 (36.5)	56 (16.2)	27 (7.8)	

Variables	Freq. (n)	%
<b>Household wealth quintiles</b>		
Lowest	83	6.9
Second	311	25.9
Middle	344	28.7
Fourth	241	20.1
Highest	221	18.4
<b>Main source of drinking water</b>		
Improved sources	989	82.4
Unimproved sources	211	17.6
<b>Location of source of water</b>		
In own dwelling	639	53.3
In own yard/plot	126	10.5
Elsewhere	435	36.2
<b>Unavailability of water for one day/week</b>		
Yes	421	35.5
No	779	64.5
<b>Clean water</b>		
Yes	100	8.3
No	1100	91.7
<b>Toilet facility</b>		
Improved facility	1087	90.6
Unimproved facility	113	9.4
<b>Sharing facility with other households</b>		
Yes	113	9.4
No	1087	90.6

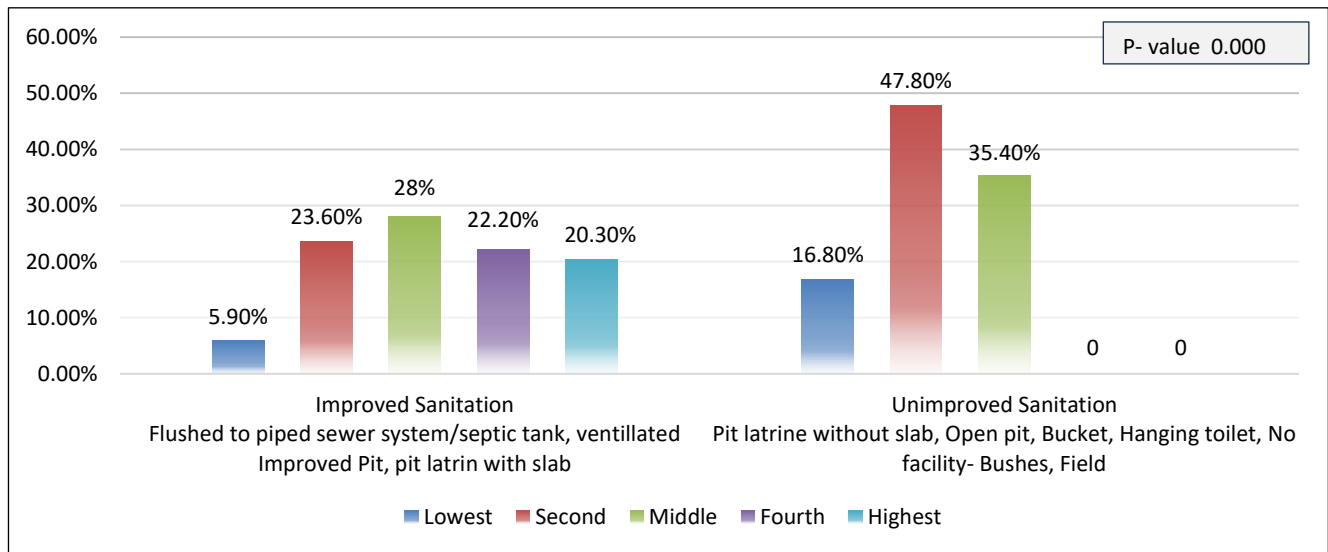
We used the chi-square test to draw inferential statistics by segregating these variables on the basis of five economic strata ranging from lowest, second, middle, fourth to highest. There are clear-cut inequalities that exist between the strata in regard to WASH and wealth characteristics.



**Figure 1. Access to improved sources of drinking water among wealth quintiles**

Households are unequally segregated between the different wealth quintiles based on provinces, e.g., Sindh contains 67% of the households in the 4th and 5th quintiles, while Baluchistan contains 48.5% of the households in the 1st and 2nd quintiles. There seems to be a trend that exists between the net income generation of provinces and the distribution of population among the different strata. Similar trends can also be seen in regard to WASH characteristics.

Figure 1 shows the distribution of households among the five strata compared with access to improved sources of drinking water. The lowest quintile has the least access to these sources, comprising only 4.8% of the total. The location of these sources shows a discrepancy, with 44.7% of the households having water sources available in their own dwelling, comprising the two highest quintiles. Families that access water sources elsewhere rather than in their homes comprise almost ½ of the total sample from the lower 2 quintiles. The water availability for at least 1 day per week is 13% greater among the lower quintiles.



**Figure 2. Utilization of improved/unimproved sanitation facilities among wealth quintiles**

Figure 2 shows access to improved and unimproved sanitation facilities among the households. Improved facility access is relatively equal among the quintiles, with the exception of the lowest quintile, which does not have the means to access these facilities. Compared to households with unimproved facilities, almost all of the households that have access to these facilities are in the lower quintiles. Forty-four percent of the richer households can afford to build their own latrines and sanitation access inside their own dwellings, while those that access these facilities elsewhere are mostly in the second quintile. Access to separate kitchens is almost equal among households, with the exception of the lowest quintile.

### Discussion

Our study revealed a tendency toward lower-quality WASH access as wealth decreases, which can lead to an increased risk of disease and infection. The study highlighted that households belonging to lower socioeconomic strata face disproportionately greater challenges in obtaining safe and sufficient water and appropriate sanitation facilities. Inequalities are apparent between the provinces when

compared on the basis of wealth quintiles and access to facilities of water and sanitation.

These disparities in WASH services have significant implications for individuals' and communities' health and safety. A lack of clean water can cause diarrhea, cholera, and typhoid fever. Inadequate sanitation can contribute to the spread of disease through water contamination and the improper disposal of waste.

Additionally, it is crucial to address the underlying social and cultural factors that contribute to WASH challenges. The literature suggests that gender inequality, lack of education, and traditional beliefs can hinder the adoption of proper hygiene practices. This can also reduce the sustainable management of water and sanitation resources (11). Therefore, any integrated approach must also include efforts to promote gender equality, provide education on hygiene practices, and challenge harmful cultural norms that perpetuate poor WASH conditions. By addressing these root causes, sustainable improvements in WASH indicators can be achieved and maintained in the long term.

For example, in rural communities where there is a lack of education and traditional beliefs surrounding menstruation, women and girls may face stigma and discrimination. This may lead to inadequate menstrual hygiene management and infection risk. To address this issue, an integrated approach could involve implementing comprehensive menstrual health education programs that challenge harmful cultural norms. This could provide access to affordable and sustainable menstrual products and ensure safe and private sanitation facilities for women and girls (12, 13).

Our study provides valuable insights, but it has limitations. The survey, although representative of the population, had many missing values, which made full use of the sample size impractical. Removing all the missing data would jeopardize the generalizability of the data; thus, a randomized sampling strategy was utilized to obtain valid results from the overall sample. Additionally, data limitations, including potential underreporting, could have influenced the accuracy of our results to some extent. These limitations should be addressed in future research to enhance comprehensiveness and reliability.

## Conclusion

In conclusion, our study sheds light on disparities in household WASH covariates across different socioeconomic strata within Pakistan. These disparities underscore the urgent need for targeted interventions and policies that ensure equitable access to clean water, adequate sanitation, and proper hygiene practices for all. By addressing these disparities, we can significantly contribute to enhancing public health, reducing disease burdens, and promoting sustainable development in the studied nation and beyond.

### Ethical Approval:

This study was undertaken using a publicly available database from DHS, analysis of which does not require any ethical approval from a concerned body.

**Financial support and sponsorship:** None

**Conflict of interest:** None declared.

### Authors' Contribution:

**NUK:** Major contributions in the concept and design of the study, Participation in acquisition of the data, Involvement in drafting of the article.

**NA:** Participation in acquisition of the data, Involvement in drafting of the article.

**RN:** Participation in analysis and interpretation of the data.

**RA & NBS:** Involvement in drafting of the article

**SR:** Revising the manuscript for submission

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