

Knowledge, Attitude and Practices Regarding Water, Sanitation & Hygiene in Rural Community Lahore, Punjab

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ABSTRACT

Background: Inadequate water, sanitation, and hygiene contribute to the transmission of diarrhoeal and other communicable diseases, particularly in rural communities with limited environmental and health resources. **Objective:** To assess knowledge, attitudes, and practices regarding water, sanitation, and hygiene among residents of a rural community in Lahore, Punjab. **Methods:** This descriptive cross-sectional study was conducted over four months among 300 participants recruited through convenience sampling. Data was collected using a structured, closed-ended questionnaire covering demographic characteristics and WASH-related knowledge, attitudes, and practices. Categorical variables were summarized using frequencies and percentages. **Results:** Unsafe water was recognized as a cause of diarrhoeal disease by 241 (80.3%) participants, while 293 (97.7%) acknowledged that water quality could affect health. Favourable attitudes were reported toward keeping water containers clean, 295 (98.3%), and handwashing after latrine use, 285 (95.0%). However, 115 (38.3%) participants agreed that washing with water alone was sufficient for hand hygiene. Protected water sources were reported by 289 (96.3%), handwashing facilities near household latrines by 297 (99.0%), and good overall WASH practices by 237 (79.0%). **Conclusion:** Although most participants reported favourable WASH knowledge, attitudes, and practices, important misconceptions remained regarding disease prevention, waste disposal, children's stool, and effective handwashing. **Keywords:** Knowledge; Attitudes; Practices; Water, Sanitation and Hygiene; Rural Community; Diarrheal Disease.

INTRODUCTION

Water, sanitation, and hygiene are fundamental determinants of communicable-disease prevention and community health. Unsafe drinking water, inadequate environmental sanitation, and poor hand-hygiene practices facilitate the transmission of gastrointestinal and other infectious diseases, particularly in communities where access to safe water, soap, drainage, and waste-management services is limited. Evidence from school and community settings indicates that knowledge alone does not necessarily result in sustained hygienic behaviour because practices are also influenced by motivation, habit, available resources, and the surrounding physical and social environment (1,2).

Access to safe drinking water and adequate sanitation remains uneven across many resource-constrained settings. Community studies from South Asia and international assessments have documented persistent deficiencies in drinking-water safety, sanitation coverage, and access to essential WASH services (3-5). These deficiencies extend beyond the immediate risk of infection and may adversely affect nutrition,

education, dignity, household productivity, and general well-being. Rural communities may experience a disproportionate burden because of limited infrastructure, irregular water-quality monitoring, inadequate drainage, unsafe waste disposal, and restricted access to health information.

Effective WASH interventions therefore require more than the provision of physical infrastructure. Community perceptions of water safety, understanding of disease transmission, attitudes toward sanitation, and routine behaviours such as handwashing, safe disposal of household waste, protection of water sources, and hygienic management of human and animal waste determine whether available services are used consistently. Previous research conducted in India, emergency WASH settings, and rural Malaysia has emphasized the importance of assessing community knowledge, perceptions, and practices when designing locally acceptable and sustainable WASH programmes (6-8).

Studies conducted in rural Ethiopia, Bangladesh, and Azad Kashmir have reported varying levels of WASH knowledge, attitudes, and practices and have identified persistent discrepancies between awareness and routine behaviour (9-11). However, findings from these settings may not be directly transferable to rural communities in Lahore because water availability, sanitation infrastructure, educational attainment, household organization, socioeconomic conditions, and exposure to public-health information differ across geographical and cultural contexts. Evidence describing WASH-related knowledge, attitudes, and practices among rural adults in Lahore remains limited.

Accordingly, this study aimed to assess knowledge, attitudes, and practices regarding water, sanitation, and hygiene among adult residents of a rural community in Lahore, Punjab. It also sought to identify areas of adequate awareness, persistent misconceptions, and potentially unsafe practices that may inform contextually appropriate health education and community-based WASH planning.

MATERIALS AND METHODS

A descriptive cross-sectional study using a quantitative survey approach was conducted over a four-month period in a rural community of Lahore, Punjab. The target population comprised adult residents of the selected rural community. Eligible community members were recruited through convenience sampling during the data-collection period. The required sample size was estimated using the formula for descriptive studies, resulting in a final sample of 300 participants.

Data were collected using a structured, closed-ended questionnaire adapted for the target population. The instrument recorded demographic characteristics, including age, gender, educational level, occupation, family type, and monthly household income. It also contained separate domains assessing participants' knowledge, attitudes, and practices concerning drinking-water safety, water contamination, sanitation, hygiene, diarrhoeal disease transmission, drainage, household waste disposal, management of animal dung, latrine-related hygiene, handwashing, household cleanliness, and personal hygiene.

Knowledge items primarily used dichotomous yes-or-no or other categorical response options. These items assessed participants' recognition of unsafe water as a potential cause of diarrhoeal disease, the possibility of water contamination, the health effects of inadequate handwashing, the relationship between water quality and health, exposure to WASH information, satisfaction with drainage, perceived safety of household drinking water, and adequacy of water collected for daily household needs.

Attitudes were assessed using statements rated on a five-point Likert scale ranging from strongly agree to strongly disagree. The statements examined beliefs concerning the continuous importance of clean water, prevention of waterborne disease through safe water consumption, contamination caused by defecation near water sources, boiling of drinking water, cleanliness of water-storage containers, health risks associated with cattle dung and street waste, transmission of diarrhoeal disease, handwashing after latrine use, contamination from children's stool, the adequacy of washing hands with water alone, and the relationship between hand hygiene and diarrhoeal disease. Negatively worded statements were interpreted in the opposite direction when describing favourable or unfavourable attitudes.

The practice domain assessed the type of household water source, estimated daily water consumption, household solid-waste disposal, materials used for handwashing, availability of handwashing facilities near household latrines, cleanliness of the household compound, and regularity of fingernail trimming. Water sources were reported according to whether they were protected or unprotected, while waste disposal and household cleanliness were recorded according to the categories used in the study questionnaire.

Completed questionnaires were collected from the enrolled participants and organized according to demographic, knowledge, attitude, and practice variables. The statistical analysis was descriptive. Categorical variables were summarized as frequencies and percentages and presented in numbered tables accompanied by concise narrative descriptions. Because the study used a descriptive cross-sectional design, the results were interpreted as estimates of the characteristics and responses of the surveyed population and not as evidence of temporal improvement, behavioural change, or causal relationships.

RESULTS

A total of 300 participants were included in the analysis. All categorical variables are presented as frequencies and percentages.

Table 1. Demographic Characteristics of the Participants

Characteristic	Category	n (%)
Age, years	16–25	182 (60.7)
	26–40	83 (27.7)
	41–60	35 (11.7)
Gender	Male	177 (59.0)
	Female	123 (41.0)
Educational level	Uneducated	89 (29.7)
	Basic education	91 (30.3)
	Secondary education	61 (20.3)
	Higher secondary education	33 (11.0)
	Graduation	26 (8.7)
Occupation	Labourer	66 (22.0)
	Self-employed	89 (29.7)
	Government employee	34 (11.3)
	Private employee	22 (7.3)
	Other	89 (29.7)
Family type	Nuclear	119 (39.7)
	Joint	111 (37.0)
	Extended	42 (14.0)
	Blended	1 (0.3)
	Single-parent	27 (9.0)

The majority of participants were aged 16–25 years, accounting for 182 (60.7%) of the sample. There were 177 (59.0%) male and 123 (41.0%) female participants. Basic education was reported by 91 (30.3%) participants, while 89 (29.7%) had no formal education. Self-employment and other occupations were each reported by 89 (29.7%) participants. Nuclear families were the most frequently reported family type, comprising 119 (39.7%) participants, followed by joint families, comprising 111 (37.0%).

Table 2. Knowledge and Perceptions Regarding Water, Sanitation, and Hygiene

Item	Response	n (%)
Does unsafe water cause diarrhoea?	Yes	241 (80.3)
	No	59 (19.7)
Can water become contaminated?	Yes	257 (85.7)
	No	43 (14.3)
Should handwashing be performed using clean water?	Yes	247 (82.3)
	No	53 (17.7)
Can animal dung cause disease?	Yes	258 (86.0)

Item	Response	n (%)
Received WASH information during the preceding six months	No	42 (14.0)
	Yes	144 (48.0)
Satisfied with the household drainage system	No	156 (52.0)
	Yes	186 (62.0)
Effect identified for not washing hands	No	114 (38.0)
	Diarrhoeal diseases	293 (97.7)
Measure identified for preventing acute watery diarrhoea	No diarrhoea	7 (2.3)
	Medication	226 (75.3)
	Hygiene	74 (24.7)
Can water quality affect health?	Yes	293 (97.7)
	No	7 (2.3)
Household water perceived as safe to drink	Yes	226 (75.3)
	No	74 (24.7)
Collected water perceived as sufficient for daily needs	Yes	211 (70.3)
	No	89 (29.7)

WASH: water, sanitation, and hygiene.

Most participants recognized that water could become contaminated, with 257 (85.7%) responding affirmatively, while 241 (80.3%) identified unsafe water as a cause of diarrhoeal disease. Animal dung was recognized as a potential cause of disease by 258 (86.0%) participants, and 247 (82.3%) indicated that clean water should be used for handwashing. Nearly all participants, 293 (97.7%), recognized a relationship between water quality and health and identified diarrhoeal disease as a potential consequence of inadequate handwashing.

Only 144 (48.0%) participants reported receiving WASH-related information during the preceding six months. Satisfaction with the drainage system was reported by 186 (62.0%) participants. Household drinking water was perceived as safe by 226 (75.3%), while 211 (70.3%) considered the amount of water collected sufficient for their daily needs. When asked about the prevention of acute watery diarrhoea, 226 (75.3%) identified medication and 74 (24.7%) identified hygiene.

Table 3. Attitudes Toward Water Safety, Sanitation, and Hygiene

Attitude statement	Strongly agree, n (%)	Agree, n (%)	Neutral, n (%)	Disagree, n (%)	Strongly disagree, n (%)	Favourable response, n (%)
Clean water is important only during illness†	32 (10.7)	30 (10.0)	49 (16.3)	109 (36.3)	80 (26.7)	189 (63.0)
Safe and sufficient water consumption can prevent waterborne diseases	102 (34.0)	160 (53.3)	12 (4.0)	23 (7.7)	3 (1.0)	262 (87.3)
Defecating near a water source can contaminate it	139 (46.3)	122 (40.7)	25 (8.3)	11 (3.7)	3 (1.0)	261 (87.0)
Boiling water before drinking kills disease-causing microorganisms	157 (52.3)	115 (38.3)	19 (6.3)	8 (2.7)	1 (0.3)	272 (90.7)
Water containers should always be kept clean	201 (67.0)	94 (31.3)	4 (1.3)	1 (0.3)	0 (0.0)	295 (98.3)
Improperly managed cattle dung can cause health problems	166 (55.3)	121 (40.3)	6 (2.0)	6 (2.0)	1 (0.3)	287 (95.7)
Disposing of waste in the streets poses no health risks†	48 (16.0)	52 (17.3)	24 (8.0)	95 (31.7)	81 (27.0)	176 (58.7)
Poor personal hygiene and sanitation cause diarrhoeal diseases	102 (34.0)	144 (48.0)	21 (7.0)	18 (6.0)	15 (5.0)	246 (82.0)
Diarrhoeal diseases can be transmitted	58 (19.3)	173 (57.7)	39 (13.0)	27 (9.0)	3 (1.0)	231 (77.0)
Waste can serve as a breeding ground for flies and rodents	128 (42.7)	132 (44.0)	20 (6.7)	16 (5.3)	4 (1.3)	260 (86.7)
Washing hands after using the latrine prevents diarrhoeal diseases	192 (64.0)	93 (31.0)	8 (2.7)	2 (0.7)	5 (1.7)	285 (95.0)
Children's stool is free of disease-causing microorganisms†	47 (15.7)	39 (13.0)	35 (11.7)	114 (38.0)	65 (21.7)	179 (59.7)
Washing hands with water alone is sufficient for hand hygiene†	56 (18.7)	59 (19.7)	27 (9.0)	146 (48.7)	12 (4.0)	158 (52.7)
Washing hands is particularly important after eating	129 (43.0)	152 (50.7)	9 (3.0)	9 (3.0)	1 (0.3)	281 (93.7)
Hand hygiene is unrelated to diarrhoeal diseases†	32 (10.7)	54 (18.0)	46 (15.3)	110 (36.7)	58 (19.3)	168 (56.0)

Favourable responses were calculated as strongly agree plus agree for positively worded statements and disagree plus strongly disagree for negatively worded statements. †Negatively worded statement.

Favourable attitudes were most frequently observed for keeping water containers clean, reported by 295 (98.3%) participants; recognizing the health risks of improperly managed cattle dung, reported by 287 (95.7%); and acknowledging the protective role of handwashing after latrine use, reported by 285 (95.0%). Favourable responses were also common for the importance of handwashing after eating, 281 (93.7%); boiling drinking water, 272 (90.7%); and preventing waterborne disease through safe and sufficient water consumption, 262 (87.3%).

Several misconceptions nevertheless remained. Although 176 (58.7%) participants rejected the statement that street waste poses no health risk, 100 (33.3%) agreed or strongly agreed with it. Similarly, 179 (59.7%) rejected the statement that children's stool is free from disease-causing microorganisms,

whereas 86 (28.7%) agreed or strongly agreed. Only 158 (52.7%) rejected the view that washing with water alone is sufficient for hand hygiene, while 115 (38.3%) agreed or strongly agreed. In addition, 168 (56.0%) rejected the statement that hand hygiene is unrelated to diarrhoeal disease, whereas 86 (28.7%) agreed or strongly agreed with this misconception.

Table 4. Reported Water, Sanitation, and Hygiene Practices

Practice variable	Category	n (%)
Household water source	Protected pump	289 (96.3)
	Unprotected river	11 (3.7)
Daily water consumption per person	<10 L	117 (39.0)
	>10 L	183 (61.0)
Solid-waste disposal	Appropriate	221 (73.7)
	Inappropriate	79 (26.3)
Material used for handwashing	Water and soap/ash	295 (98.3)
	Water only	5 (1.7)
Handwashing facility available near household latrine	Yes	297 (99.0)
	No	3 (1.0)
Household compound cleanliness	Appropriate	272 (90.7)
	Inappropriate	28 (9.3)
Overall WASH practice category	Good	237 (79.0)
	Poor	63 (21.0)
Regular fingernail trimming	Yes	283 (94.3)
	No	17 (5.7)

WASH: water, sanitation, and hygiene.

Protected pumps were reported as the household water source by 289 (96.3%) participants, while 11 (3.7%) reported using an unprotected river source. Daily water consumption exceeding 10 litres per person was reported by 183 (61.0%) participants. Appropriate solid-waste disposal was reported by 221 (73.7%), whereas 79 (26.3%) reported inappropriate disposal practices.

Water with soap or ash was reported as the handwashing material by 295 (98.3%) participants, and 297 (99.0%) reported having a handwashing facility near the household latrine. Appropriate household-compound cleanliness was reported by 272 (90.7%) participants, and regular fingernail trimming was reported by 283 (94.3%). Based on the overall classification reported in the study, 237 (79.0%) participants were categorized as having good WASH practices and 63 (21.0%) as having poor practices.

DISCUSSION

This descriptive cross-sectional study identified generally favourable knowledge, attitudes, and self-reported practices regarding water, sanitation, and hygiene among the surveyed rural community in Lahore. Most participants recognized the relationship between unsafe water and diarrhoeal disease, understood that water could become contaminated, and acknowledged that water quality could affect health. Positive attitudes were particularly evident regarding the cleanliness of water-storage containers, the health risks associated with improperly managed cattle dung, and the preventive importance of handwashing after latrine use. Most participants also reported using protected water sources, having access to handwashing facilities near household latrines, and regularly using water with soap or ash for handwashing. However, important misconceptions and potentially unsafe perceptions remained, indicating that favourable responses were not uniform across all WASH domains.

Awareness of the relationship between water and disease was relatively high. Unsafe water was recognized as a cause of diarrhoeal disease by 80.3% of participants, while 85.7% acknowledged that water could become contaminated and 97.7% recognized that water quality could affect health. These findings broadly correspond with community-based studies from Ethiopia and India in which many participants demonstrated awareness of water contamination and sanitation-related disease transmission (9,14,15). Nevertheless, approximately one-fifth of the present sample did not recognize unsafe water as a cause of diarrhoea, and 14.3% did not acknowledge the possibility of water contamination. These

findings identify a continuing need for clear community education concerning contamination pathways, household water handling, and the relationship between unsafe water and enteric disease.

Only 48.0% of participants reported receiving WASH-related information during the preceding six months. This finding is important because regular access to health information may reinforce established knowledge, address misconceptions, and support the adoption of protective behaviour. Previous research has emphasized that hygiene behaviour is influenced not only by awareness but also by motivation, habit, available infrastructure, and repeated exposure to health-promotion messages (1,2,8,10,11). Community education should therefore extend beyond one-time awareness activities and incorporate repeated, contextually appropriate messages delivered through local healthcare services, schools, community organizations, and other accessible communication channels.

The responses concerning acute watery diarrhoea require particular attention. Although most participants recognized diarrhoeal disease as a possible consequence of inadequate handwashing, 75.3% identified medication rather than hygiene when asked about its prevention. This response may reflect confusion between disease prevention and treatment. It suggests that participants may understand the consequences of poor hygiene without fully distinguishing preventive measures from therapeutic management. Future WASH communication should clearly differentiate prevention through safe water, sanitation, handwashing, and food hygiene from the clinical treatment of established diarrhoeal illness.

Participants generally expressed favourable attitudes toward environmental sanitation and household water safety. Most agreed that safe and sufficient water consumption could prevent waterborne disease, that defecation near water sources could cause contamination, and that boiling water could inactivate disease-causing microorganisms. These patterns are consistent with findings from rural and peri-urban communities in Ethiopia and India, where respondents commonly recognized the importance of safe water handling, sanitation, and handwashing (9,14,15). However, perceived safety should not be interpreted as confirmation of microbiological or chemical water quality. Although 75.3% considered their household water safe to drink, the study did not include objective water-quality testing. Participants' responses therefore represent perceptions of safety rather than verified potability.

The attitude results also revealed several substantial misconceptions. One-third of participants agreed or strongly agreed that disposing of waste in the street posed no health risk. More than one-quarter believed that children's stool was free of disease-causing microorganisms, while 38.3% agreed that washing hands with water alone was sufficient for hand hygiene. In addition, 28.7% agreed that hand hygiene was unrelated to diarrhoeal disease. These findings are epidemiologically relevant because incorrect beliefs concerning children's faeces, street waste, and handwashing materials may contribute to continued exposure despite otherwise favourable WASH knowledge. Educational interventions should therefore address specific misconceptions rather than relying exclusively on broad messages about cleanliness.

Most reported practices were favourable. Protected pumps were used by 96.3% of participants, 73.7% reported appropriate solid-waste disposal, 99.0% reported having a handwashing facility near the household latrine, and 94.3% reported regular fingernail trimming. The study classified 79.0% of participants as having good overall WASH practices. Similar studies have reported that access to facilities and household-level hygiene resources can support safer practices, although the translation of knowledge into sustained behaviour remains dependent on environmental and socioeconomic conditions (10,13,15). Community-led sanitation programmes and household-focused interventions may be useful when they combine infrastructure, repeated engagement, and locally acceptable behavioural strategies (12,13).

The findings should be interpreted in relation to the study's methodological limitations. Convenience sampling from a single rural community limits representativeness and prevents generalization to all rural populations in Lahore or Punjab. The cross-sectional design captures responses at one point in time

and cannot demonstrate behavioural improvement, temporal change, or causal relationships. Self-reported practices are vulnerable to recall and social-desirability bias, particularly for behaviours such as handwashing, waste disposal, household cleanliness, and fingernail trimming. The study did not include direct household observation or objective testing of drinking-water quality. In addition, the absence of inferential analysis prevented examination of relationships between demographic characteristics and WASH outcomes. The interpretation of the overall practice classification also depends on the validity and scoring properties of the questionnaire used.

Despite these limitations, the study provides community-level evidence concerning WASH knowledge, attitudes, perceptions, and reported practices in a rural area of Lahore. Its principal contribution is the identification of a mixed pattern: many participants reported favourable knowledge and practices, but misconceptions remained regarding diarrhoeal-disease prevention, street waste, children's stool, handwashing with water alone, and the relationship between hand hygiene and disease. These specific gaps can inform targeted community education, environmental sanitation initiatives, and future studies using probability sampling, validated instruments, objective observation, and water-quality assessment.

CONCLUSION

The surveyed rural community demonstrated generally favourable knowledge, attitudes, and self-reported practices regarding water, sanitation, and hygiene, including widespread recognition of water-related health risks and high reported access to protected water sources and household handwashing facilities. However, important misconceptions persisted concerning diarrhoeal-disease prevention, unsafe waste disposal, children's stool, and the adequacy of washing hands with water alone. These findings support the need for targeted, context-specific WASH education that addresses identified misconceptions while reinforcing safe water handling, sanitation, and hand-hygiene practices.

REFERENCES

1. Vivas A, Gelaye B, Aboset N, Kumie A, Berhane Y, Williams MA. Knowledge, attitudes, and practices of hygiene among school children in Angolela, Ethiopia. *J Prev Med Hyg.* 2010;51(2):73.
2. Curtis VA, Danquah LO, Aunger RV. Planned, motivated and habitual hygiene behaviour: an eleven-country review. *Health Educ Res.* 2009;24(4):655-73.
3. Amin M, Ahmed W, Kashem M. The status of safe drinking water and sanitation in Batabaria, Comilla, Bangladesh. *Ann Trop Med Public Health.* 2008;1(2):47.
4. WaterAid International. We can't wait: a report on sanitation and hygiene for women and girls. WaterAid International; 2013.
5. Hulton G, World Health Organization. Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage. World Health Organization; 2012.
6. Nath KJ, Chowdhury B, Sengupta A, editors. Study on perception and practice of hygiene and impact on health in India. *Proceedings of the South Asia Hygiene Practitioners' Workshop*; 2010.
7. Nicole W. The WASH approach: fighting waterborne diseases in emergency situations. *Environ Health Perspect.* 2015;123(1):A6.
8. Rahim NA, Sham SM, Rahman HA. Knowledge, attitude, and awareness regarding water, sanitation, and hygiene among rural residents in Kerian, Perak. *Malays J Med Health Sci.* 2022;18.
9. Berhe AA, Aregay AD, Abreha AA, Aregay AB, Gebretsadik AW, Negash DZ, et al. Knowledge, attitude, and practices on water, sanitation, and hygiene among rural residents in Tigray Region, Northern Ethiopia. *J Environ Public Health.* 2020;2020:5460168.

10. Akter T, Ali AM. Factors influencing knowledge and practice of hygiene in Water, Sanitation and Hygiene programme areas of Bangladesh Rural Advancement Committee. *Rural Remote Health*. 2014;14(3):31-40.
11. Javaeed A, Tabbasum T, Arif U, Ghauri SK, Khan SH, Wajid Z. Knowledge, attitude and practices of water, sanitation and hygiene of students in Azad Kashmir. *Rawal Med J*. 2018;43(3):536-9.
12. Nerkar SS, Tamhankar AJ, Johansson E, Lundborg CS. Improvement in health and empowerment of families as a result of watershed management in a tribal area in India: a qualitative study. *BMC Int Health Hum Rights*. 2013;13:42.
13. Tessema RA. Assessment of the implementation of community-led total sanitation, hygiene, and associated factors in Diretiyara district, Eastern Ethiopia. *PLoS One*. 2017;12(4):e0175233.
14. Abera B, Mulu W, Yizengaw E, Hailu T, Kibret M. Water safety, sanitation and hygiene-related knowledge, attitudes and practices among household residents in peri-urban areas in Northwest Ethiopia. *Ethiop J Health Dev*. 2018;32(3).
15. Kuberan A, Singh AK, Kasav JB, Prasad S, Surapaneni KM, Upadhyay V, et al. Water and sanitation hygiene knowledge, attitude, and practices among household members living in a rural setting in India. *J Nat Sci Biol Med*. 2015;6(Suppl 1):S69.