



## AWARENESS AND PRACTICE ON WATER, SANITATION AND HYGIENE (WASH) AMONG RESIDENTS OF RURAL PUDUCHERRY

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### ABSTRACT

**Background:** Water, sanitation, and hygiene (WASH) are essential determinants of public health in preventing water-borne diseases. Despite improvements in sanitation coverage in India, gaps still exist between awareness and actual hygienic practices in rural communities.

**Objectives:** To evaluate WASH knowledge and behaviours among rural adults in Puducherry and identify key influences on these aspects.

**Methods:** A cross-sectional community survey with 208 adults from rural Puducherry households, chosen via probability proportional to size sampling. A validated semi-structured questionnaire captured sociodemographic data, awareness levels, and hygiene practices, analyzed with descriptive and inferential statistics to associations.

**Results:** Most participants demonstrated good awareness regarding safe drinking water and hand hygiene practices. However, gaps were observed in practices such as household water treatment and sanitation behaviour. Sociodemographic factors including age, education, income, family type, and exposure to awareness programmes showed significant association with WASH awareness and practices. A positive correlation was observed between awareness and practice scores.

**Conclusion:** Although awareness regarding WASH was relatively high, consistent adoption of hygienic practices remains suboptimal. Strengthening community-based health education and improving access to safe water and sanitation facilities are important to bridge the knowledge–practice gap and promote healthier rural communities.

**Keywords:** Water, Sanitation And Hygiene (WASH), Hygiene Practices, Sanitation, Safe Drinking Water.

### INTRODUCTION

Access to safe drinking water, proper sanitation, and hygiene (WASH) remains a keystone of health and development of humans. Globally, 2 billion people still lack access to safe drinking water, while 3.6 billion remain without safely managed sanitation facilities. In addition, 1 in 3 people lack basic handwashing facilities with soap and water, which contributes to approximately 1.4 million annual preventable deaths, mainly from diarrheal, cholera, typhoid, and parasitic infections.<sup>1-3.</sup>

The challenges in India are equally striking. Only 57% of rural households reported improved sanitation coverage, and the coverage of securely managed drinking water is significantly below national targets, according to NFHS-5 (2019–21)<sup>4.</sup> Even while programs like Jal Jeevan Mission and Swachh Bharat Mission have improved their infrastructure, there are still differences in terms of contamination, open defecation, and improper hygiene practices. According to NFHS-5 data, diarrhoea in children under three years old was substantially correlated with shared sanitary facilities, inappropriate stool disposal, and the absence of a separate kitchen.<sup>5</sup>

The Union Territory of Puducherry, despite relatively favorable health indicators, faces similar rural WASH challenges. An epidemiological



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investigation in Mudaliarpur revealed that over 12% of households in the affected area reported acute diarrheal disease, and lack of safe water supply and sanitation were identified as key drivers.<sup>6</sup> Furthermore, field observations and local assessments suggest that gaps remain in latrine use, household-level water treatment, and waste handling, highlighting the gap between infrastructure and consistent behavioral practice.

One major barrier to improving WASH outcomes lies in the disconnect between awareness and practice. A cross-sectional study across five states in rural India found that while many individuals were aware of proper hand hygiene, over half continued to use only water and not soap for hand washing at critical times. Socioeconomic disparities further influenced both awareness and behaviors.<sup>7</sup> Similarly, a community-based survey in Odisha documented only 7% of households have purified drinking water and 40% still practice open defecation, which were significantly associated with both acute and chronic illnesses.<sup>8</sup>

Hence, measuring community-level awareness and practices related to water, sanitation, and hygiene in rural Puducherry is critical in bridging the gap between infrastructure provision and behavioral compliance. Therefore, this study aimed to assess the knowledge, attitude, and practice relating to water, sanitation and hygiene among residents of selected rural villages in Puducherry and to determine the factors associated with them.

## METHODOLOGY

A community-based cross-sectional study was conducted in the adopted villages by the tertiary care hospital at Ariyur, Puducherry. The study was carried out over a period of six months following approval from the Institutional Ethics Committee. The study population comprised adult residents ( $\geq 18$  years) from selected households in the seven adopted villages surrounding the institution. Adults aged  $\geq 18$  years residing in the selected households and willing to provide informed consent were included in the study.

The sample size was calculated using the formula:  $n = Z^2 p(1-p) / d^2$ . Assuming a prevalence (p) of 14% for adequate knowledge and practices regarding Water, Sanitation and Hygiene (WASH),<sup>9</sup> with a 95% confidence interval ( $Z = 1.96$ ) and an absolute precision (d) of 5%, 20% drop outs, the minimum required sample size was 208 households. The total number of households across the seven selected villages was 3,444. Probability Proportional to Size (PPS) sampling was applied to ensure representativeness across villages. Approximately 14% of households were selected from each village based on their household size. Within each village, households were selected using systematic random sampling from the updated household list obtained from village records.

## Selection of Respondents within Household (Kish Grid Technique)

In households with more than one eligible adult ( $\geq 18$  years), only one respondent was selected using the Kish grid technique to ensure random and unbiased selection. The procedure was as follows:

1. All eligible adult members in the household were listed in descending order of age, irrespective of gender.
2. Each eligible member was assigned a serial number.
3. A pre-prepared Kish grid table was used to identify the selected respondent based on the number of eligible members and the household serial number.
4. The individual corresponding to the selected number was interviewed.

If the selected individual was unavailable during the first visit, two repeat visits were made. Households were considered non-responsive if the selected participant was unavailable after three visits and were not substituted. This method ensured equal probability of selection among eligible members and minimized interviewer bias.

## Data Collection Procedure

Data were collected by trained medical interns through a house-to-house survey conducted during both morning and evening hours to maximize participation. Each participant was requested to allocate 15–20 minutes to complete the questionnaire. A semi-structured, pre-tested questionnaire in Tamil (local language) was used. The questionnaire comprised three sections:

- **Section I:** Socio-demographic characteristics
- **Section II:** Awareness of WASH – Items assessing knowledge and attitudes regarding water handling and sanitation
- **Section III:** Practices of WASH – Self-reported practices related to water treatment, storage, sanitation, and hygiene

## Validity and Reliability of questionnaire

**Content Validity:** The questionnaire was evaluated by a panel of 5 subject experts in Community Medicine and Public Health to assess relevance, clarity, simplicity and comprehensiveness of items related to Water, Sanitation, and Hygiene (WASH). Necessary modifications were made based on expert suggestions to ensure that all domains of knowledge, attitude, and practice were adequately covered. Each item was rated by experts on a 4-point relevance scale. The Content Validity Index (CVI) was calculated and items with a CVI  $\geq 0.78$  were retained.

**Face Validity:** Face validity was assessed during pilot testing to ensure that questions were understandable, culturally appropriate, and logically structured for the study population. Minor linguistic modifications were made to improve clarity in the Tamil version of the questionnaire.

**Reliability:** The questionnaire was piloted among approximately 15% of the calculated sample (in a population similar to but not included in the final study area) to assess clarity, feasibility, time required for administration, and internal consistency. Necessary modifications were made before final data collection. Internal consistency of the knowledge and attitude domains was assessed using Cronbach’s alpha coefficient. A Cronbach’s alpha value of  $\geq 0.70$  was considered acceptable for this study. If removal of any item significantly increased the alpha value, such items were reviewed and modified or excluded to improve scale reliability.

**Scoring**

**Awareness:** Each correct response was scored as 1 and incorrect or “Don’t know” responses were scored as 0. The total awareness score was

calculated by summing correct responses and converted into percentages. Adequate:  $\geq 60\%$ , Inadequate:  $< 60\%$ .

**Practice:** Appropriate practices were scored as 1 and inappropriate practices as 0. The total practice score was converted into percentage. Good practice:  $\geq 60\%$ , Poor practice:  $< 60\%$ .

**Statistical analysis**

Data were entered in Microsoft Excel and analysed using IBM SPSS Statistics version 23.0. Frequencies and percentages were done for categorical variables, mean and standard deviation for continuous variables. Chi-square test for association between categorical variables. Multivariate regression analysis was applied to identify independent factors associated with knowledge, attitudes, and practices. A *p*-value  $< 0.05$  was considered statistically significant.

**RESULTS**

Table 1: Socio-Demographic Profile of the Participants ( N = 208)

Variable	Category	Number	Percentage
Age in years	18 - 30	53	25.5
	30 - 45	48	23.1
	45 – 60	44	21.2
	60 - 75	29	14.0
	>75	34	16.3
Sex	Female	120	57.7
	Male	88	42.3
Religion	Hindu	193	92.8
	Christian	7	3.4
	Muslim	7	3.4
	Atheist	1	0.5
Education	No Formal Education	34	16.3
	Primary School	14	6.7
	Middle School	16	7.7
	High School	46	22.1
	Higher Secondary	40	19.2
	Graduate	41	19.7
	Professional and Above	17	8.2
Occupation	Unemployed	58	27.9
	Unskilled Worker	33	15.9
	Semiskilled Worker	22	10.6
	Skilled Worker	42	20.2
	Clerical/Shop/Farm	23	11.1
	Semi-profession	15	7.2
	Professional	15	7.2
Socio economic status	Class I	141	67.8
	Class II	40	19.2
	Class III	12	5.8
	Class IV	15	7.2
Marital Status	Married	145	69.7
	Unmarried	33	15.9
	Widow	26	12.5
	Separated/ Divorced	4	1.9
Type of Family	Nuclear Family	145	69.7
	Three generation	42	20.19
	Joint family	21	10.1
Children <5 Years	No	155	74.52

	Yes	53	25.48
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The results were given in table and figures (Table 1-4 and figure 1). The study includes 208 respondents. The socio-demographic profile of the respondents showed that the majority were female (57.7%), rest the males (42.3%). Most respondents belonged to the middle to older age groups, suggesting that household decision-makers were primarily represented in the survey. The population was predominantly Hindu (92.8%), and nearly one-fifth (19.7%) were graduates, while 16.3% had no

formal education. With respect to occupation, respondents were distributed across unemployed, skilled, and unskilled categories. A large proportion (67.8%) were classified in socio-economic Class I according to the scale applied, though this distribution appears skewed towards higher classes and requires cautious interpretation. Nuclear families (69.7%) predominated, and about one-fourth of households (25.5%) reported having children under five years of age.

Table 2: Level of Awareness and Practice on WASH among the participants (n = 208)

S. No.	Awareness Question	Adequate n (%)
1	Safe water is necessary for good health	186 (89.42)
2	Drinking water should be stored properly	189 (90.87)
3	Unclean water handling can cause health problems	158 (75.96)
4	Open-air defecation can lead to diseases	125 (60.1)
5	Washing hands before and after eating is necessary	202 (97.12)
6	Personal hygiene should be maintained	182 (87.5)
7	Garbage bins should be covered	181 (87.02)
8	Footwear should be used while going to toilet	139 (66.83)
S. No.	Practice Question	Good n (%)
1	Main source: piped/public tap	148 (71.2)
2	No shortage of drinking water	160 (76.9)
3	Water treatment (boiling/filtering)	90 (43.3)
4	Sanitary latrine available	162 (77.9)
5	Do not share latrine with outsiders	152 (73.1)
6	Proper garbage disposal	161 (77.4)
7	Handwashing water: piped/public	179 (86.1)
8	Use of soap for handwashing	163 (78.4)
9	Washing hands before & after eating	202 (97.1)

Awareness regarding water, sanitation, and hygiene was generally high. Nearly nine out of ten respondents (89.4%) recognised the importance of safe water for health, and 87.5% acknowledged the need for personal hygiene. Safe storage of drinking water was correctly identified by 90.9%, while 97.1% agreed that handwashing before and after eating is essential. However, awareness was lower for certain critical aspects: only 60.1% reported that open defecation can lead to disease transmission and 66.8% acknowledged the protective role of wearing footwear while using toilets. This indicates that although general WASH knowledge is satisfactory, gaps remain in perceptions regarding disease risks and protective measures.

The analysis of water supply and availability revealed that 71.2% of households depended on piped or public tap water as their main source, with borewell and dug well constituting smaller shares. While a majority (76.9%) reported no shortage of drinking water in the previous month, nearly one-fourth did experience shortage, which can contribute to unsafe coping mechanisms such as using contaminated sources or storing water improperly. In terms of drinking water treatment

practices, less than half (43.3%) of the households reported treating water before drinking, either by boiling or filtration, while 56.7% consumed untreated water. This reflects a significant knowledge – practice gap: although most respondents recognized the importance of safe water, fewer translated this knowledge into practice. Sanitation indicators were relatively better. Sanitary latrines were available in 77.9% of households, while 22.1% reported not having access. Moreover, 73.1% did not share their latrine with outsiders, whereas 26.9% did, potentially affecting privacy and consistent usage. These figures suggest that latrine coverage in the study area is higher than the national rural average but still leaves a notable minority unserved. With regard to waste management, 77.4% of households reported safe disposal through garbage collection points or municipal vehicles, whereas 22.6% resorted to open dumping. Although the majority follow recommended practices, unsafe disposal in one-fifth of households poses risks for vector breeding and environmental contamination. Handwashing practices were encouraging by self-report. A majority (86.1%) used piped/public water for

handwashing, and 78.4% reported using soap. Almost all participants (97.1%) claimed to wash hands before and after eating. While these indicators appear highly satisfactory, the possibility

of social desirability bias cannot be ruled out, as actual observed compliance in similar studies is often lower.

Table 3: Association between Socio-Demographic Variables with Awareness on WASH

Variables		n	Awareness on WASH		X <sup>2</sup>	p-value
			Adequate	Inadequate		
Age (in years)	18 - 30	53	07.5	92.5	12.243	0.008*
	30 - 45	48	04.2	95.8		
	45 - 60	44	04.5	95.5		
	60 - 75	29	03.4	96.6		
	>75	34	26.5	73.5		
Gender	Female	120	10	90	0.650	0.465
	Male	88	6.8	93.2		
Family Income	Class I	141	5.7	94.3	7.684	0.034*
	Class II	40	12.5	87.5		
	Class III	12	8.3	91.7		
	Class IV	15	26.7	73.3		
Education	Illiterate	34	20.6	79.4	16.585	0.003*
	Primary	14	21.4	78.6		
	Middle school	16	18.8	81.2		
	High school	46	6.5	93.5		
	Higher Secondary	40	00	100		
Occupation	Graduate	58	3.4	96.6	8.023	0.172
	Unemployed	58	15.5	84.5		
	Unskilled	33	12.1	87.9		
	Skilled	42	4.8	95.2		
	Semi-skilled	45	4.5	97.5		
Type of family	Professional	30	6.6	93.3	12.255	0.002*
	Nuclear	145	4.1	95.9		
	Joint	21	14.3	85.7		
Previous awareness session	Three Generation	42	21.4	78.6	7.352	0.004*
	Yes	72	1.4	98.6		
	No	136	12.5	87.5		

\*p<0.05, statistically significant

Age was significantly associated with awareness, with higher proportions of adequate awareness observed among older participants ( $\chi^2 = 12.243$ ,  $p = 0.008$ ). Family income also showed a significant association, with participants from higher income groups reporting better awareness ( $\chi^2 = 7.684$ ,  $p = 0.034$ ). Education was strongly associated with

awareness ( $\chi^2 = 16.585$ ,  $p = 0.003$ ), although the pattern indicated that inadequate awareness persisted even among higher educational levels. Type of family was another significant factor, with participants from joint and three-generation families having better awareness compared to nuclear families ( $\chi^2 = 12.255$ ,  $p = 0.002$ ).

Table 4: Association between Socio-Demographic Variables with Practice on WASH

Variables		n	Practice on WASH		X <sup>2</sup>	p-value
			Good	Poor		
18 - 30	53	66	34	17.850	18 - 30	53
	48	64.6	35.4		30 - 45	48
	44	38.6	61.4		45 - 60	44
	29	31	69		60 - 75	29
	34	67.6	32.4		>75	34
Female	120	65.8	34.2	12.758	Female	120
	88	40.9	59.1		Male	88
Class I	141	44.7	55.3	20.277	Class I	141
	40	77.5	22.5		Class II	40
	12	83.3	16.7		Class III	12
	15	73.3	26.7		Class IV	15

Illiterate	34	73.5	26.5	21.479	Illiterate	34
Primary	14	92.9	7.1		Primary	14
Middle school	16	68.8	31.2		Middle school	16
High school	46	43.5	56.5		High school	46
Higher Secondary	40	55	45		Higher	40
Graduate	58	41.3	58.7		Secondary	58
					Graduate	58

\*p<0.05, statistically significant

The analysis of socio-demographic variables with practice on WASH revealed statistically significant associations across multiple factors. Age was significantly associated with practice ( $\chi^2=17.850$ ,  $p=0.001$ ), with better practice observed among the youngest and oldest groups compared to middle age groups. Gender showed a strong influence ( $\chi^2=12.758$ ,  $p=0.001$ ), with females demonstrating higher adequate practice than males. Family income

was also significantly related ( $\chi^2=20.277$ ,  $p=0.001$ ), where individuals from higher-income categories reported better practice. Type of family also showed significance ( $\chi^2=9.596$ ,  $p=0.009$ ), with three-generation families demonstrating better practice. Importantly, prior exposure to awareness sessions was strongly associated ( $\chi^2=21.472$ ,  $p=0.001$ ), with those previously exposed reporting markedly better practice.

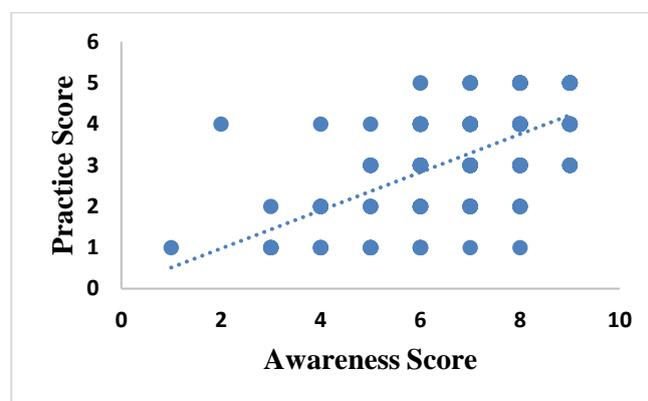


Figure 1: Relationship between Awareness and Practice Scores

A significant positive correlation was observed between the awareness score and practice score in the scatter plot ( $r = 0.596$ ,  $p < 0.001$ ). The better awareness on WASH is associated with better practice on WASH. (Figure 1)

## DISCUSSION

This cross-sectional study assessed awareness and practices related to Water, Sanitation and Hygiene (WASH) among 208 residents which reveals encouraging levels of awareness but highlight persistent gaps in translation to practice, reflecting a common trend across rural Indian communities.

The majority of participants were female (57.7%), Hindu (92.8%), and from nuclear families (69.7%). A relatively high proportion (67.8%) belonged to the upper socioeconomic class, which may reflect the catchment characteristics of the study villages. Whereas comparable studies in rural Tamil Nadu and Odisha reported a predominance of lower-income groups, which limited access to sanitation and safe water facilities.<sup>9,10</sup> Thus, while the higher SES in our study may partly explain better WASH coverage, it also indicates that results may not be generalizable to poorer rural settings.

There was a high level of knowledge overall, with

almost 90% acknowledging the value of clean water and 97% stating that handwashing is necessary both before and after meals. These levels are higher than those seen in Odisha, where maternal knowledge gaps were substantially linked to diarrheal morbidity in children under five, and Perambalur district, Tamil Nadu, where only 75% of participants indicated acceptable awareness.<sup>10,11</sup> However, only 60.1% of respondents recognized the dangers of open defecation, indicating that its contribution to the spread of illness may be underestimated. Misconceptions about sanitation practices continued despite Swachh Bharat Mission advertising, according to a 2016 study conducted in South India by Veerapu et al.<sup>12</sup>

More than three-fourths (78%) of households had sanitary latrines at home, with 73.1% not sharing with outsiders. This figure is higher than national rural coverage (57% in NFHS-5).<sup>13</sup> Recent studies in Odisha and Tamil Nadu reported latrine coverage between 50–65%.<sup>14,15</sup> Nonetheless, 22% still lacked access, highlighting residual inequities. Garbage disposal practices were also better in this study, with 77.4% reporting safe garbage disposal, compared to 52% in rural Perambalur.<sup>11</sup>

Water supply indications were positive, with 71.2%

using piped/public tap water and 76.9% reporting no shortages. However, just 43.3% of drinking water was treated before consumption, indicating a significant knowledge-practice gap. Given the susceptibility to outbreaks, this figure—while better than the Odisha study's 7%—remains a public health concern.<sup>8</sup> In fact, Puducherry has seen cases of cholera connected to improper water storage in the past, which emphasizes the necessity of ongoing health education.<sup>6</sup>

Hand hygiene practices were appreciable, with 78.4% reporting soap use and 97% claiming handwashing before and after meals. These rates are higher than those observed nationally, where up to 40% of rural households continue to rely on water alone.<sup>16</sup> However, self-report bias must be acknowledged, as observed compliance in other studies is often lower than stated.<sup>17,18</sup>

Significant associations were observed between WASH awareness and age, income, education, family type and exposure to awareness sessions. Similarly, practice was positively associated with gender, socioeconomic status, education, occupation, and awareness exposure. These findings align with national evidence showing that education and income are consistent predictors of better hygiene behaviors.<sup>19,20</sup> The strong correlation between awareness and practice ( $r = 0.596$ ,  $p < 0.001$ ) underscores the role of knowledge in shaping behaviours, though structural barriers remain.

### CONCLUSION AND RECOMMENDATIONS

Although awareness regarding water, sanitation and hygiene (WASH) was generally high among the study participants in Puducherry, gaps remain in the translation of knowledge into consistent hygienic practices. Strengthening community-based health education and improving access to safe water and sanitation facilities are essential to bridge this knowledge–practice gap and promote healthier rural communities. Regular community awareness activities led by frontline health workers can help reinforce the importance of safe water, sanitation, and hygiene in everyday life. In addition, improving the availability and use of safe drinking water and sanitation facilities through initiatives such as Swachh Bharat Mission and Jal Jeevan Mission can support the adoption of healthier practices within rural communities.

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