American Journal of Medicine and Health Care (AJMHC)

VOLUME 1 ISSUE 2 (2026)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of
Medicine and Health Care (AJMHC)

Volume 1 Issue 2, Year 2024
ISSN: 2993-6519 (Online)
DOI: https://doi.org/10.54536/ajth.v1i2.7363
https://journals.e-palli.com/home/index.php/ajmhc

Knowledge and Preventive Practices on Water Contamination Among Rural Philippine Household Heads

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Article Information

Received: May 29, 2026

Accepted: August 16, 2026

Published: September 05, 2026

Keywords

Household Head, Knowledge, Preventive Practice, Rural Water Safety, Water Contamination

ABSTRACT

Household-level water safety is dependent on how water is collected, stored, handled and protected from contamination, especially in rural areas that utilize mixed water sources. This quantitative descriptive-correlational study explored water contamination knowledge and prevention practices for 261 household heads selected through stratified random sampling from eight sitios in a rural Philippine barangay and examined the relationship between the two variables. Data were gathered using a researcher-developed questionnaire covering socio-demographic and water-use characteristics, knowledge across four prevention domains, and preventive practices measured on a five-point scale. Descriptive statistics and Spearman's rho were used for analysis. Overall knowledge was moderate (mean raw score = 15.89, SD = 2.42); proper disposal had the highest mean percentage score (83.30%), whereas water handling had the lowest (75.25%). Preventive practice was high overall (M = 4.35, SD = 0.61), with very high water-storage practice (M = 4.56, SD = 0.48). Knowledge and preventive practice were very weakly and non-significantly correlated (rho = 0.047, p = 0.446). The results suggest that good household water-safety habits can be maintained by experience, habit and local context beyond knowledge alone, and water handling is still a key topic for practical health education.

INTRODUCTION

Water contamination can occur at the source and in water collection, storage, transfer and household use. Unsafe drinking water, sanitation and hygiene are in many cases the cause of preventable illness and mortality, especially in low-resource areas where the population uses either mixed or untreated water sources (Ando *et al.*, 2025; Wolf *et al.*, 2023). At the household level, the safety of water is affected by daily actions like covering storage containers, maintaining hand hygiene, disposing of waste properly and not getting contaminated while handling water.

The findings of various settings suggest poor storage conditions, unsafe water transfer and poor sanitation can contribute to microbial water quality between the source and the point of use (Makokove *et al.*, 2022; Manga *et al.*, 2021; McGuinness *et al.*, 2020). These risks are particularly relevant in rural areas where water use is based on availability and purpose and can change and/or be switched from treated source to untreated source.

Rural water, sanitation and hygiene in the Philippines remain a last-mile public health concern (Molina *et al.*, 2021; Ulep *et al.*, 2024). Household heads are often the main decision-makers in water access, storage, hygiene and use and therefore their knowledge and preventive practices are important to contamination prevention (Omondi & Jackson, 2022). But health knowledge does not always translate into behavior in practice; previous Philippine awareness-practice studies suggest that routine, feasibility, prior experience and household context play a role in when preventive actions are done regularly (Nagal, Lariosa, *et al.*, 2025; Nagal, Ningal, & Invina, 2025).

This study therefore aimed to determine the levels of knowledge and preventive practices regarding water contamination among household heads in a rural Philippine community, describe their household water-storage and source patterns, and test the relationship between knowledge and preventive practice. By examining both cognitive and behavioral dimensions of household water safety, the study provides evidence that may support locally appropriate health education and community-level water-safety interventions.

LITERATURE REVIEW

Household water quality can deteriorate after collection even when the original source is comparatively safe. A systematic review by Manga *et al.* (2021) identified storage vessels and user practices as important determinants of household water quality, while field studies in rural India and Zimbabwe similarly documented the contribution of storage management, hygiene, transfer, and handling to changes in microbial quality between source and use (Makokove *et al.*, 2022; McGuinness *et al.*, 2020). In remote and unpiped communities, household water, sanitation and hygiene practices also influence pathogen exposure, which underscores the importance of prevention at the point of use (Mattos *et al.*, 2021).

Rural households often make practical water-use decisions in response to access, convenience, infrastructure and competing domestic needs (Yusuf & Abdi, 2025). Reviews of household water demand and conservation behavior show that past habits, perceived feasibility and context can affect water use decisions (Abu-Bakar *et al.*, 2021; Koop *et*

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al., 2019). In the Philippines, water, sanitation and hygiene access disparities are still significant and mixed-source use may persist where reliable household connections are not always available (Denosta, 2025; Molina *et al.*, 2021; Ulep *et al.*, 2024).

Knowledge remains an important component of preventive health behavior, but information alone may be insufficient to produce consistent practice. Studies of water, sanitation, and hygiene knowledge and behavior among rural populations emphasize the need for understandable and context-sensitive education (Berhe *et al.*, 2020). Health-promotion perspectives further recognize that behavior can be influenced by perceived benefits, barriers, situational factors, and previous behavior in addition to knowledge (Rojas-Torres *et al.*, 2025). Philippine correlational studies in other communicable-disease contexts have likewise reported that awareness and practice do not necessarily move together in a simple linear manner (Nagal, Lariosa, *et al.*, 2025; Nagal, Ningal, & Invina, 2025).

These findings support interventions that combine information with practical demonstrations and community participation. Community-based approaches to water contamination have emphasized localized and behavior-focused strategies rather than information-only activities (Maneeprakorn *et al.*, 2024). The present study addressed the need for local evidence by assessing household heads' knowledge and reported preventive practices across water storage, hygiene, disposal, and handling. The null hypothesis tested was that knowledge would not be significantly related to preventive practices regarding water contamination.

MATERIALS AND METHODS

Research Design

The study used a quantitative descriptive-correlational design to describe household heads' knowledge and preventive practices regarding water contamination and to test the relationship between these variables. The design measured existing conditions and associations without manipulating variables or inferring causality.

Study Setting, Population, and Sampling

The study was conducted in a rural Philippine barangay composed of eight sitios. The target population consisted of 748 households. The eligible group for study were household heads 18 years or older, permanent residents of the study area, and primary decision-makers in household health, hygiene, and water-use matters. Using Yamane's formula at a 95% confidence level and a 5% margin of error, the required sample was 261 respondents. Participants were selected through stratified random sampling with proportional allocation across the eight sitios.

Research Instrument

Data were collected using a researcher-developed structured questionnaire with three parts. Part I assessed socio-demographic and water-use characteristics, including age, sex, civil status, household size, educational attainment, occupation, type of water source, and type of water storage. Part II measured knowledge of water-contamination prevention using 20 multiple-choice items across four domains: water storage, proper hygiene, proper disposal, and water handling. Part III measured preventive practices across the same four domains using a five-point Likert scale from 1 (never) to 5 (always).

Content validation was performed by experts in nursing, public health, and environmental health. The mean Experts' Content Evaluation score was 21.33 out of 25. Pilot testing was conducted among 30 household heads who were not included in the final sample. Reliability was acceptable for the knowledge scale using Kuder-Richardson Formula 20 (KR-20 = 0.846) and for the practice scale using Cronbach's alpha (alpha = 0.810).

Data Collection Procedure

After administrative approval, the researchers coordinated with local authorities and identified eligible household heads according to the sampling plan. The purpose, procedures, expected time commitment, and voluntary nature of participation were explained to each respondent. Written informed consent was obtained before questionnaire administration. Questionnaires were distributed and personally retrieved by the researchers to promote completeness and consistency.

Data Analysis

Data were encoded and analyzed using SPSS version 21. Frequency and percentage summarized socio-demographic characteristics and water-source and storage patterns. Mean and standard deviation described knowledge and practice scores overall and by domain. Spearman's rho tested the relationship between knowledge and preventive practices because the Kolmogorov-Smirnov test indicated a non-normal distribution ($p < 0.001$). Statistical significance was set at $p < 0.05$.

Ethical Considerations

The study involved adult household heads and was conducted after review and approval by the research panel of the College of Nursing, Aklan State University. No separate ethical approval number was issued because a formal institutional ethics review board was not available at the College at the time of the study; the College research panel served as the approving body for the protocol. Participation was voluntary, written informed consent was obtained, respondents could decline or withdraw without penalty, and no personally identifying information was included in the dataset or final report. Completed questionnaires and encoded data were kept confidential and stored securely with access limited to the researchers.

RESULTS AND DISCUSSION

Socio-demographic Profile of Household Heads

Most respondents were between 40-59 years old (46.0%), male (67.4%) and married (59.0%). Almost half lived in households of three to four persons (46.0%). High school graduates formed the largest educational group (28.4%), college graduates (21.1%) and skilled laborers (33.0%) as the largest occupational group. Table 1 shows the full socio-demographic distribution.

Table 1: Socio-demographic Distribution of Respondents

	Variables	**f**	**%**
Age	18 to 25 years old	3	1.10
	26 to 39 years old	56	21.50
	40 to 59 years old	120	46.00
	≥ 60 years old	82	31.40
	Total	261	100.00
Sex	Male	176	67.40
	Female	85	32.60
	Total	261	100.00
Civil Status	Married	154	59.00
	Single	36	13.80
	Cohabiting/Living-in	29	11.10
	Widow/Widower	34	13.00
	Separated	8	3.10
	Total	261	100.00
Educational Attainment	No Education	1	0.40
	Elementary Level	27	10.30
	Elementary Graduate	16	6.10
	High School Level	40	15.30
	High School Graduates	74	28.40
	Vocational Courses	8	3.10
	College Level	40	15.30
	College Graduate	55	21.10
	Total	261	100.00
Household Size	1-2 persons	50	19.20
	3-4 persons	120	46.00
	5-6 persons	59	22.60
	≥7 persons	32	12.30
	Total	261	100.00
Occupation	Farming	54	20.70
	Fishing	1	0.40
	Government Service	30	11.50
	Small Business Owner	25	9.60
	Skilled Laborer	86	33.00
	Housewife/Homemaker	48	18.40
	Student	1	0.40
	Unemployed	16	6.10
	Total	261	100.00

The profile shows that household water decisions in this community were most commonly reported by adults with established domestic responsibilities. Household water behavior is shaped not only by formal knowledge but also by routine, experience, resource availability, and the practical feasibility of changing daily practices (Abu-

Bakar *et al.*, 2021; Koop *et al.*, 2019). The presence of respondents with low formal schooling also reinforces the value of simple and locally understandable water-safety education (Berhe *et al.*, 2020).

Water Storage and Source Patterns

Pails or buckets were the dominant household storage containers for every reported purpose: drinking (85.4%), cooking (86.6%), toilet use (95.0%), crop planting (93.1%), and livestock use (90.8%). Table 2 shows the detailed storage distribution.

This process demonstrates the significance of container management: commonly used household vessels can become points of contamination when cleaning, covering, dipping and transfer practices are inadequate (Manga *et al.*, 2021; McGuinness *et al.*, 2020).

Table 2: Water Storage System Usage of Respondents

Water Storage	**f**	**%**
Drinking		
Pail or Bucket	223	85.40
Earthenware Pot or Jar	2	0.80
Water Bottles	33	12.60
Water Drum	3	1.10
Water Tank	0	0.00
Others	0	0.00
Total	261	100.00
Cooking		
Pail or Bucket	226	86.60
Earthenware Pot or Jar	13	5.00
Water Bottles	7	2.70
Water Drum	4	1.50
Water Tank	11	4.20
Others	0	0.00
Total	261	100.00
Toilet		
Pail or Bucket	248	95.00
Earthenware Pot or Jar	0	0.00
Water Bottles	0	0.00
Water Drum	9	3.40
Water Tank	4	1.50
Others	0	0.00
Total	261	100.00
Crop-planting		
Pail or Bucket	243	93.10
Earthenware Pot or Jar	0	0.00
Water Bottles	1	0.40
Water Drum	12	4.60
Water Tank	5	1.90
Others	0	0.00
Total	261	100.00
Livestock		
Pail or Bucket	237	90.80
Earthenware Pot or Jar	0	0.00
Water Bottles	0	0.00
Water Drum	18	6.90
Water Tank	6	2.30
Others	0	0.00
Total	261	100.00

Water sources reported were different for household use; wells and NAWASA tap water were among the most prominent sources, while water pumps, reservoirs, irrigation and water-refilling stations were less frequently reported for specific use as described in Table 3.

Table 3: Water Sources of Respondents

Drinking		
Wells	83	31.80
Water Pump	0	0.00
Irrigation	0	0.00
Reservoir	0	0.00
Water Refilling Stations	0	0.00
NAWASA (Tap Water)	178	68.20
Total	261	100.00
Cooking		
Wells	4	1.50
Water Pump	17	6.50
Irrigation	1	0.40
Reservoir	4	1.50
Water Refilling Stations	2	0.80
NAWASA (Tap Water)	233	89.30
Total	261	100.00
Toilet		
Wells	4	1.50
Water Pump	22	8.40
Irrigation	0	0.00
Reservoir	5	1.90
Water Refilling Stations	0	0.00
NAWASA (Tap Water)	230	88.10
Total	261	100.00
Crop-planting		
Wells	10	3.80
Water Pump	24	9.20
Irrigation	7	2.70
Reservoir	9	3.40
Water Refilling Stations	1	0.40
NAWASA (Tap Water)	210	80.50
Total	261	100.00
Livestock		
Wells	12	4.60
Water Pump	25	9.60
Irrigation	2	0.80
Reservoir	12	4.60
Water Refilling Stations	0	0.00
NAWASA (Tap Water)	210	80.50
Total	261	100.00

The coexistence of tap water and local water sources is indicative of the mixed-source conditions in rural Philippine water, sanitation and hygiene (Molina *et al.*, 2021; Ulep *et al.*, 2024). Water quality can deteriorate in storage and handling even after it is collected, so point-of-use practices are important (Makokove *et al.*, 2022; Mattos *et al.*, 2021).

Knowledge of Water Contamination Prevention

Household heads were fairly well-versed in all four domains (Table 4). Proper disposal had the highest mean percentage score (83.30%), followed by water storage (80.54%) and proper hygiene (78.75%), while water handling had the lowest score (75.25%). The raw knowledge score was 15.89 (SD = 2.42) which is

Table 4: Mean Levels of Household Heads' Knowledge of Water Contamination Prevention

Domains	Mean Percentage	SD	Description
Water Storage	80.54%	0.20	Moderate Knowledge
Proper Hygiene	78.75%	0.17	Moderate Knowledge
Proper Disposal	83.30%	0.17	Moderate Knowledge
Water Handling	75.25%	0.22	Moderate Knowledge
	Mean Raw Score	**SD**	**Description**
Composite Score	15.89	2.42	Moderate Knowledge

NOTE: Knowledge interpretation: 90.00-100.00% / 18-20 = High; 70.00-89.99% / 14-17 = Moderate; 50.00-69.99% / 10-13 = Low; below 50.00% / below 10 = Very Low.

moderate knowledge. The respondent's knowledge level is summarized in Table 4.

The lower score for handling water suggests that the less visible contamination pathways during transfer and point-of-use contact may be less well understood than more observable sanitation actions. Rural water, sanitation and hygiene research has also emphasized the importance of context-sensitive education on practical behaviors that directly affect contamination risk (Berhe *et al.*, 2020; Mattos *et al.*, 2021). For this community, education should go beyond general awareness and show concrete practices such as keeping containers covered, cleaning storage vessels and dippers, and avoiding hand contact with stored water. Contextualized and experiential approaches may strengthen such interventions by connecting health information with familiar environments, locally available resources, and activities that allow participants to apply recommended practices directly (Nagal, 2021).

Preventive Practices

Preventive practice was high overall, with a composite mean of 4.35 (SD = 0.61). Water storage had the highest mean and was classified as very high practice (M = 4.56, SD = 0.48). Proper disposal (M = 4.47, SD = 0.58), proper hygiene (M = 4.43, SD = 0.59) and water handling (M = 3.92, SD = 0.98) were all classified as high practice. This is shown in Table 5.

Table 5: Mean Levels of Household Heads' Preventive Practices on Water Contamination

Domains	Mean	SD	Description
Water Storage	4.56	0.48	Very High Practice
Proper Hygiene	4.43	0.59	High Practice
Proper Disposal	4.47	0.58	High Practice
Water Handling	3.92	0.98	High Practice
Composite Score	4.35	0.61	High Practice

NOTE: Practice interpretation: 4.51-5.00 = Very High; 3.51-4.50 = High; 2.51-3.50 = Moderate; 1.51-2.50 = Low; 1.00-1.50 = Very Low.

The pattern of stronger reported practice than knowledge may reflect behaviors maintained through habit, previous experience, household routines, and community norms. Research on household water behavior shows that practical constraints and established routines can strongly influence water-related actions (Abu-Bakar *et al.*, 2021; Koop *et al.*, 2019). This pattern also supports the use of demonstrations and participatory activities that reinforce correct routine behavior rather than relying on information alone (Maneeprakorn *et al.*, 2024). Community-responsive educational approaches may further strengthen such interventions by treating local knowledge and lived experience as resources for designing contextually meaningful learning activities (Nagal *et al.*, 2026).

Relationship Between Knowledge and Preventive Practices

Spearman's rho showed a very weak positive relationship between knowledge and preventive practice (rho = 0.047), but the association was not statistically significant (p = 0.446; N = 261), as presented in Table 6. The null hypothesis was therefore not rejected. In this sample, higher knowledge did not correspond to meaningfully

Table 6: Spearman's rho Test of the Relationship Between Knowledge and Preventive Practice

Spearman rho		Knowledge	Practice
Knowledge	Correlation Coefficient	1	0.047
	Sig. (2-tailed)		0.446
	N	261	261
Practice	Correlation Coefficient	0.047	1
	Sig. (2-tailed)	0.446	
	N	261	261

higher reported preventive practice.

This finding is consistent with health-promotion perspectives in which behavior is influenced by perceived benefits, perceived barriers, situational influences, and previous behavior in addition to knowledge (Rojas-Torres *et al.*, 2025). It also parallels Philippine awareness-practice studies showing that knowledge and preventive behavior may not have a strong direct association (Nagal, Lariosa, *et al.*, 2025; Nagal, Ningal, & Invina, 2025). The result should not be interpreted to mean that knowledge is unimportant; rather, it suggests that household water-safety programs should combine knowledge-building with feasible, repeated, and locally relevant behavior supports.

Strengths and Limitations

The study was strengthened by stratified random sampling in eight sitios with a good sample size and researcher-developed instrument that was reliable in practice. But interpretation should consider several limitations. This study was conducted in one rural barangay which makes it difficult to generalize to other Philippine communities. Preventive practices were self-reported and could be influenced by social desirability. The study also did not include laboratory testing of household water quality so the findings are only for knowledge and reported behavior and not microbiological contamination in actual household water. Future studies could combine survey results with household observation, water-quality testing, and qualitative interviews to better understand why some water-safety behaviors are still strong but others are weak.

CONCLUSION

Rural household heads in this study had moderate knowledge but generally high preventive practices on water contamination. The best knowledge domain was on proper disposal whereas the weakest was on water handling. Water-storage practice was very high, hygiene, disposal, and handling practices were high. Knowledge and preventive practice had a very weak and non-significant relationship and this indicates that household water-safety behavior may be influenced by routine, experience, feasibility and local context as well as knowledge. These findings are useful for community health programs, as they suggest that information campaigns should be paired with practical demonstrations of safe water transfer, container cleaning, covered storage, clean dipping and other typical household routines. The results are limited by the single-community setting, self-reported practices and the absence of laboratory water quality testing. Future studies should include more barangays, direct observation and objective water quality measures to enhance the evidence for rural water-safety interventions.

Acknowledgements

The authors would like to thank the household heads, barangay officials, and local health personnel for their participation in the study. The authors also thank the research panel of the College of Nursing, Aklan State University for reviewing and approving the study protocol.

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