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Household Water, Sanitation, and Hygiene Conditions and Reported Diarrhea Occurrence in Selected Barangays of Sampaloc, Manila

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Abstract

Water, sanitation, and hygiene (WaSH) conditions are central to preventing diarrheal disease, particularly in densely populated urban communities. This study examined household WaSH conditions and their relationship with reported diarrhea occurrence among residents of Barangays 496, 497, and 501 in Sampaloc, Manila. A descriptive cross-sectional design was used, involving 150 adults equally distributed across the three barangays. Data were collected through a locally developed structured questionnaire measuring clean-water availability, accessibility of household and public toilets and handwashing stations, hygiene practices, and household experiences of diarrhea. Frequencies, percentages, means, standard deviations, Pearson correlations, and group-comparison procedures were applied. Respondents reported favorable clean-water availability (M = 4.00), household toilets (M = 4.06), household handwashing stations (M = 3.97), and hygiene practices (M = 4.16). Public handwashing stations (M = 2.02) and public toilets (M = 1.88) were rated poorly. Reported diarrhea occurrence was low (M = 1.78). Hygiene practices showed a statistically significant but weak negative association with reported diarrhea occurrence (r = -.165, p = .044), whereas clean-water availability, sanitation accessibility, and the overall WaSH rating were not significantly associated with diarrhea. Sanitation accessibility differed by barangay, while hygiene practices differed by monthly household income, educational attainment, and barangay. The findings indicate that favorable household WaSH conditions can coexist with deficiencies in public sanitation. Barangay-specific infrastructure improvements, inclusive facility design, sustained hygiene education, and stronger service monitoring are therefore warranted.

Keywords: *water, sanitation, and hygiene; diarrhea occurrence; household hygiene practices; public sanitation facilities; urban community health; Manila*

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1. Introduction

Access to safe water, adequate sanitation, and appropriate hygiene practices constitutes a fundamental requirement for protecting individual and community health. Collectively described as water, sanitation, and hygiene, or WaSH, these conditions influence exposure to pathogens transmitted through contaminated water, food, surfaces, and fecal matter. Their importance is particularly pronounced in densely populated urban communities, where overcrowding, shared facilities, aging infrastructure, and variations in household resources can increase the likelihood of communicable disease transmission. Improving WaSH conditions is therefore central to Sustainable Development Goal 6, which calls for universal and equitable access to safe water, sanitation, and hygiene.

Diarrhea remains among the most common health consequences associated with inadequate WaSH conditions. It is generally characterized by the passage of three or more loose or watery stools within a 24-hour period and may result from bacterial, viral, or parasitic infections transmitted through contaminated food or water or through poor hygiene practices (Meisenheimer et al., 2022). Although many episodes are self-limiting, diarrhea can lead to dehydration, missed work or school activities, healthcare expenditures, and severe complications, particularly among children, older persons, and individuals with underlying health vulnerabilities.

Evidence indicates that improvements in drinking-water quality, sanitation, and hand hygiene can reduce the risk of diarrheal disease. Wolf et al. (2022) found that drinking-water, sanitation, and handwashing interventions were associated with reductions in diarrhea, although the magnitude of benefit differed by intervention quality, service level, and context. Prüss-Ustün et al. (2019) likewise identified inadequate water, sanitation, and hygiene as important contributors to the global burden of disease. These findings support treating water access, sanitation accessibility, and hygiene practices as related but analytically distinct dimensions.

The distinction between infrastructure and behavior is particularly important in assessing household health conditions. A household may have a water connection, private toilet, or handwashing area, but the protective value of these resources depends on water safety, continuity of supply, availability of soap, cleanliness of facilities, and regular adherence to preventive practices. Handwashing before food preparation and eating, after toilet use, and after handling waste is a critical barrier to fecal-oral transmission. Proper waste disposal, avoidance of shared personal hygiene items, cleaning of frequently touched surfaces, and safe handling of drinking water similarly contribute to reducing exposure to infectious agents. Haque and Freeman (2021) emphasized that sustainable WaSH outcomes require not only infrastructure but also implementation strategies that integrate evidence-based practices into routine household and community behavior.

The Philippine setting illustrates the need to examine both access and practice. Although basic water and sanitation coverage has expanded, densely populated and low-income urban communities may still experience inconsistent service delivery, insufficient public sanitation facilities, and limited capacity to maintain hygiene resources. UNICEF Philippines (2017) highlighted persistent inequalities in access to safely managed water and sanitation services, reinforcing the need to assess not only whether services exist but whether they are safe, reliable, and usable.

Urban settings also present conditions that may not be captured by household access statistics. Residents may have private toilets and handwashing areas but encounter poorly maintained or inaccessible facilities in markets, streets, transport areas, schools, workplaces, and other shared environments. Such conditions are relevant because disease transmission does not occur exclusively within the home. Public facilities that are unavailable, unsanitary, or inaccessible to older persons and persons with disabilities may undermine favorable household conditions.

Sampaloc, Manila is a densely populated district containing residential, commercial, formal, and informal community environments. Population density and frequent interaction in shared spaces create a context in which household and public WaSH conditions may jointly influence health risks. While many households have formal water connections, differences may remain in service continuity, sanitation accessibility, maintenance, and hygiene behavior. Localized assessment is therefore necessary because conditions may vary even among adjacent barangays.

Previous research has established the broad relationship between WaSH and diarrheal disease, but important contextual gaps remain. Many studies focus on children younger than five years, rural populations, schools, emergency settings, or large-scale interventions. Comparatively less attention has been given to adult household respondents in dense urban barangays where household infrastructure may be generally available but public facilities and behavioral consistency remain uneven. Moreover, some studies combine water, sanitation, and hygiene into a single index, potentially obscuring differences among these dimensions.

Accordingly, this study assessed household water, sanitation, and hygiene conditions and their relationship with reported diarrhea occurrence among adult residents of Barangays 496, 497, and 501 in Sampaloc, Manila. It evaluated associations rather than causal effects because the study used a cross-sectional survey and self-reported household experiences.

Objectives of the Study

This study aimed to examine household water, sanitation, and hygiene conditions and their relationship with reported diarrhea occurrence in selected barangays of Sampaloc, Manila. Specifically, it sought to:

1. describe the respondents according to age, sex, educational attainment, monthly household income, and length of residence;
2. assess WaSH conditions in terms of clean-water availability, accessibility of toilets and handwashing stations, and adoption of proper hygiene practices;
3. determine the reported frequency of diarrhea occurrence among the respondents' households;

4. examine the relationship between clean-water availability, sanitation accessibility, hygiene practices, and reported diarrhea occurrence; and
5. determine whether WaSH conditions differ according to the respondents' demographic characteristics and barangay location.

2. Review of Related Literature

2.1 Water, Sanitation, Hygiene, and Diarrheal Disease

Diarrheal disease is closely associated with exposure to infectious agents transmitted through contaminated food, unsafe water, inadequate sanitation, and poor hygiene. Its causes include bacterial, viral, and parasitic pathogens, with transmission commonly occurring through the fecal-oral route or through contaminated food, drinking water, hands, and household surfaces (Meisenheimer et al., 2022). The burden is particularly substantial in low- and middle-income settings where reliable water services, adequate sanitation infrastructure, and sustained hygiene practices remain unevenly distributed.

The global evidence consistently identifies inadequate WaSH as a preventable contributor to diarrheal morbidity and mortality. Prüss-Ustün et al. (2019) attributed a substantial share of adverse health outcomes in low- and middle-income countries to insufficient water, sanitation, and hygiene. Wolf et al. (2022) further showed that improvements in drinking-water quality, sanitation, and handwashing were associated with lower diarrheal risk, although the degree of protection varied according to the type and quality of service provided.

Household-level evidence also indicates that diarrhea risk is shaped by the interaction of several WaSH conditions rather than by a single environmental factor. Ko and Sakai (2022) emphasized the importance of improved water supply, sanitation, hand hygiene, household water treatment, and safe water storage. These findings indicate that reducing diarrheal transmission requires multiple barriers against contamination, including safe water at the point of use, hygienic sanitation, and consistent preventive behavior.

The literature therefore supports examining water, sanitation, and hygiene as related but distinct components. A community may have extensive water coverage while still experiencing sanitation deficiencies or inconsistent hygiene behavior. Assessment should consequently distinguish physical access from the quality, functionality, use, and maintenance of available services.

2.2 Household Water and Sanitation Infrastructure

Access to water and sanitation infrastructure is a prerequisite for effective hygiene, but the presence of facilities does not necessarily indicate that services are safe, reliable, or equitably accessible. Haque and Freeman (2021) observed that the WaSH sector continues to face difficulties in delivering functional, scalable, and sustainable services, particularly in low- and middle-income countries. Water systems may become unreliable because of intermittent supply, contamination, inadequate maintenance, weak monitoring, or deteriorating infrastructure. Sanitation facilities may similarly be available but unusable because of poor maintenance, lack of water and soap, inconvenient location, or limited accessibility.

Research on drinking-water interventions illustrates the importance of evaluating water beyond nominal access. Household treatment, safe storage, and point-of-use management may reduce exposure when centralized systems do not consistently guarantee safe water (Ko & Sakai, 2022). Wolf et al. (2022) likewise distinguished between basic and higher service levels, indicating that more protective services may yield larger health benefits. Water access should therefore be evaluated in relation to continuity, sufficiency, quality, pressure, response to interruptions, and availability of alternative sources.

Sanitation conditions also encompass more than toilet ownership. Adequate sanitation requires that facilities be functional, hygienic, supplied with water, safely managed, and usable by all household and community members. McMichael (2019) found that school-based WaSH interventions could improve knowledge, hygiene practices, and some health outcomes, although effects varied across contexts and implementation conditions. The review demonstrated that constructing facilities alone may be insufficient when operation, maintenance, supplies, and behavioral reinforcement are neglected.

Public sanitation is especially important in densely populated communities. Even where private household toilets and handwashing areas are available, residents remain exposed to shared environments such as streets,

transport areas, markets, schools, and workplaces. Poorly maintained or inaccessible public facilities may therefore undermine gains achieved at the household level.

2.3 Hygiene Practices and Behavior Change

Hygiene behavior functions as the operational link between WaSH resources and health protection. Water and sanitation facilities reduce exposure only when household members use them consistently and appropriately. Handwashing with soap after using the toilet, before preparing food, and before eating is particularly important because it interrupts the transmission of pathogens through contaminated hands and surfaces. Toney-Butler et al. (2023) identified hand hygiene as a basic and cost-effective means of preventing infectious disease, while Wolf et al. (2022) found that handwashing interventions were associated with lower diarrheal risk.

Proper hygiene extends beyond handwashing. Safe drinking-water use, systematic waste disposal, regular cleaning of frequently touched surfaces, personal cleanliness, appropriate storage of hygiene materials, and avoidance of sharing personal items may collectively reduce exposure to infectious agents. These practices are particularly relevant in crowded households, where frequent interpersonal contact and shared spaces can facilitate transmission.

Behavioral consistency is influenced by knowledge, social expectations, household routines, resource availability, and community participation. Kabir et al. (2021) found that hygiene practices were shaped by family instruction and reinforced through formal education, indicating that behavior is learned and maintained within both household and institutional settings. Hygiene promotion may consequently require repeated reminders, accessible information, modeling of appropriate practices, and opportunities for community participation.

Comparable Philippine evidence from flood-prone urban barangays indicates that preventive practices are connected not only to awareness but also to attitudes and enabling conditions, while awareness can vary by educational attainment and locality (Temporada et al., 2025).

Infrastructure and behavior should not be treated as competing explanations for health outcomes. Hygiene practices depend on the availability of water, soap, toilets, and suitable washing areas, while infrastructure achieves its intended health value only through correct and sustained use. Where water and sanitation access is already relatively high, variations in behavior may become more visible in explaining differences in reported health outcomes.

2.4 Implementation, Equity, and Community Context

The effectiveness of WaSH initiatives depends on implementation quality, local governance, financial sustainability, and community engagement. Haque and Freeman (2021) argued that implementation science can strengthen WaSH delivery by examining how evidence-based practices are incorporated into routine services under actual community conditions. This perspective shifts attention from whether an intervention is theoretically effective to whether it is accessible, accepted, maintained, and consistently implemented.

Several barriers can weaken implementation. Economic limitations may restrict household access to soap, disinfectants, safe water storage, and sanitary facilities, while inadequate knowledge may reduce adherence to appropriate hygiene behavior (John & Ajibade, 2024). Weak coordination and ineffective management may also result in deteriorating infrastructure, inconsistent service provision, and inadequate monitoring (Kumwenda, 2019). Improvements in coverage statistics therefore do not always translate into equivalent improvements in health outcomes.

Community participation is critical to sustainability. Tseole et al. (2022) emphasized that insufficient local engagement, limited awareness, inadequate monitoring, and underfunding can lead to poor maintenance or abandonment of WaSH facilities. Participation allows residents to identify context-specific problems, report service failures, support cleanliness initiatives, and contribute to interventions that reflect actual household and community needs.

Equity must also be considered. National improvements may conceal disparities affecting low-income households, informal communities, older persons, and persons with disabilities. Facilities that lack ramps, suitable space, clear signage, convenient locations, or affordable access may be formally available but functionally inaccessible. WaSH assessment should therefore evaluate not only whether facilities exist, but also who can use them, under what conditions, and with what degree of reliability.

At a broader developmental level, ASEAN evidence indicates that improvements in economic and employment indicators do not automatically produce equitable health outcomes, reinforcing the need to examine the service,

household-resource, and social-support mechanisms through which material conditions are converted into health protection (Quinto & Atento, 2025).

2.5 Synthesis and Research Gaps

The literature establishes that adequate water, sanitation, and hygiene conditions are associated with lower diarrheal risk, but it also demonstrates that health outcomes depend on more than physical infrastructure. Water must be safe, sufficient, and consistently available; sanitation facilities must be functional and maintained; and hygiene practices must be regularly performed (Prüss-Ustün et al., 2019; Wolf et al., 2022). Sustainable implementation additionally requires community participation, local monitoring, inclusive access, and responsive governance (Haque & Freeman, 2021; Tseole et al., 2022).

However, much of the available evidence concerns rural communities, young children, schools, conflict settings, or large-scale programs. Fewer studies examine adult household respondents in dense urban barangays where household water and sanitation access may be relatively favorable but public facilities and behavioral practices remain uneven. Existing studies also frequently combine water, sanitation, and hygiene into a single index, making it difficult to determine whether particular dimensions have different relationships with reported diarrhea occurrence.

The present study responds to these gaps by separately assessing clean-water availability, accessibility of household and public toilets and handwashing stations, and adoption of proper hygiene practices among adult respondents in three urban barangays. It further examines differences across demographic and geographic groups, thereby providing localized evidence for barangay-level health education, infrastructure planning, and sanitation management.

3. Methodology

3.1 Research Design

The study employed a quantitative, descriptive cross-sectional design. Data were collected at a single point in time to describe household water, sanitation, and hygiene conditions and examine their relationships with reported diarrhea occurrence. The design permitted analysis of associations and group differences but did not support causal conclusions regarding whether WaSH conditions directly reduced diarrhea.

3.2 Research Setting

The study was conducted in Barangays 496, 497, and 501 in Sampaloc, Manila. The three barangays are within the service coverage of the Maria Clara Health Center and were purposively selected based on local health information identifying the surrounding area as relevant to reported diarrhea concerns. The setting enabled a localized assessment of household water access, sanitation facilities, hygiene practices, and diarrhea occurrence in dense urban communities.

3.3 Respondents and Sampling

The respondents consisted of 150 adult residents, with 50 participants recruited from each barangay. Eligible respondents were 18-60 years old, had resided in the barangay for at least six months, belonged to residential rather than primarily commercial households, and voluntarily consented to participate.

The source manuscript reported that the minimum sample requirement was 138, as determined using G*Power. The sample was increased to 150 to provide an allowance for incomplete responses and to permit equal representation across the three barangays. The barangays were purposively selected, while eligible respondents were reported to have been selected through simple random sampling in coordination with barangay officials.

3.4 Research Instrument and Measures

Data were collected using a locally developed structured questionnaire available in English and Filipino. The instrument contained a demographic section and 51 Likert-type items covering four substantive domains.

The clean-water availability domain contained 10 items addressing water safety, sufficiency, continuity, pressure, interruptions, alternative sources, maintenance, reporting mechanisms, and responsiveness to service concerns. Accessibility of toilets and handwashing stations contained 21 items covering household toilets, household handwashing stations, public handwashing facilities, and public toilets. Adoption of proper hygiene practices contained 10 items addressing safe drinking-water use, handwashing, personal hygiene, waste disposal, surface

cleaning, compliance with sanitation guidance, avoidance of sharing personal items, and participation in community hygiene activities. Reported diarrhea occurrence contained 10 items addressing household diarrhea experiences, repeated or prolonged episodes, possible food- and water-related occurrences, medical consultation, interruption of work or school, and use of home remedies.

The WaSH items used a five-point agreement scale from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicated more favorable perceived conditions or stronger adherence to hygiene practices. Diarrhea-related items used a five-point frequency scale from 1 (never) to 5 (always), with higher scores indicating more frequent reported diarrhea occurrence. The manuscript states that health and research professionals reviewed the instrument for clarity, cultural appropriateness, and content validity; however, detailed validation indices, pilot-test findings, and reliability coefficients were not available in the archived paper.

3.5 Data-Gathering Procedure

Following institutional ethical approval and coordination with barangay officials, the researchers conducted an ocular visit and arranged face-to-face household data collection. Printed questionnaires were administered onsite over a three-day period.

Before participation, the researchers explained the study purpose, procedures, potential risks, expected benefits, confidentiality safeguards, and voluntary nature. Respondents read and signed an informed-consent form before answering the questionnaire. Researchers remained available to clarify unfamiliar terms or instructions without influencing responses. Completed questionnaires were reviewed for completeness, coded, and prepared for statistical analysis. A light snack was provided after participation as a noncoercive token of appreciation.

3.6 Data Analysis

Data were encoded and analyzed using the Statistical Package for the Social Sciences. Frequencies and percentages summarized age, sex, educational attainment, monthly household income, length of residence, and barangay distribution. Means and standard deviations were computed for clean-water availability, toilet and handwashing accessibility, hygiene practices, and reported diarrhea occurrence.

Pearson product-moment correlation coefficients examined the direction and strength of relationships between the WaSH dimensions and reported diarrhea occurrence. Statistical significance was evaluated at the .05 level. Group-comparison procedures were used to examine differences according to sex, age, monthly household income, length of residence, educational attainment, and barangay. The archived thesis identified independent-samples t tests but did not preserve the specific omnibus procedure or test statistics used for variables with more than two categories; the journal article therefore reports the available p values and interprets multi-category results as omnibus comparisons.

3.7 Ethical Considerations

The study was reviewed and approved by the Centro Escolar University Institutional Ethics Review Board. Participation was voluntary and required written informed consent. Respondents were informed of their right to decline participation, omit questions they considered sensitive, request clarification, or withdraw without penalty. Names were optional and were not linked to the analytical dataset. Access to identifiable information was restricted to authorized research personnel, and findings were reported in aggregate form in accordance with the Data Privacy Act of 2012 (Republic Act No. 10173).

4. Results and Discussion

4.1 Respondent Characteristics

The study included 150 adult respondents, with 50 participants from each of Barangays 496, 497, and 501. The age distribution was relatively balanced. Respondents aged 33-40 years constituted the largest group (22.7%), followed by those aged 18-25 years (22.0%). Respondents aged 42-49 and 50-60 years each accounted for 20.0%, while those aged 26-32 years represented 15.3%.

Females comprised 59.3% of the respondents and males 40.7%. Regarding education, 39.3% had reached or completed college, 31.3% had completed high school, 14.7% had vocational education, and 8.0% had senior high school education. Smaller proportions had elementary education, no formal education, or postgraduate education.

The largest income group reported a monthly household income of ₱11,000-₱20,000 (31.3%). Respondents earning more than ₱21,000 represented 24.0%, those earning ₱6,000-₱10,000 represented 23.3%, and those earning below ₱5,000 represented 21.3%. Half of the respondents had lived in their barangays for at least seven years: 27.3% for more than ten years and 23.3% for seven to ten years.

4.2 Household and Community WaSH Conditions

Table 1 consolidates the descriptive results for clean-water availability, toilets and handwashing stations, hygiene practices, and reported diarrhea occurrence. Household-level conditions were generally favorable, whereas public sanitation facilities received markedly lower ratings.

Table 1. *Descriptive Results for Household and Community WaSH Conditions*

Dimension or subdimension	Mean	Interpretation reported in source
Clean-water availability	4.00	Agree
Household toilets	4.06	Agree
Household handwashing stations	3.97	Agree
Public handwashing stations	2.02	Disagree
Public toilets	1.88	Disagree
Proper hygiene practices	4.16	Agree
Reported diarrhea occurrence	1.78	Never

Note. Higher WaSH scores indicate more favorable perceived conditions; higher diarrhea scores indicate more frequent reported occurrence.

Clean-Water Availability

Respondents generally perceived their household water supply as adequate, with an overall mean of 4.00. The highest-rated item identified Maynilad as the principal household water source (M = 4.40), followed by the adequacy of water for daily household needs (M = 4.38) and the consistency of clean and safe drinking water (M = 4.23).

Water pressure (M = 4.13) and minimal interruptions (M = 4.05) were also rated positively. Comparatively lower scores were recorded for regular maintenance or upgrading of the water system (M = 3.72), responsiveness of authorities to reported concerns (M = 3.75), and prompt resolution of interruptions (M = 3.77). The primary concern was therefore not basic household connection but the visibility and responsiveness of service management.

Toilets and Handwashing Stations

A substantial contrast was observed between household and public sanitation facilities. Respondents generally reported access to functional private toilets (M = 4.06) and household handwashing stations (M = 3.97). The availability of a functional private toilet received a mean of 4.16, while handwashing stations supplied with soap and water received a mean of 4.06.

Public facilities were rated substantially less favorably. Public handwashing stations obtained a subdimension mean of 2.02, while public toilets received a mean of 1.88. Respondents reported deficiencies in location, maintenance, operational condition, availability of water and soap, waiting time, affordability, signage, and accessibility. The lowest-rated item was public-toilet accessibility for persons with disabilities and older persons (M = 1.69). These results indicate that favorable household infrastructure may conceal deficiencies in the broader community environment.

Hygiene Practices

Respondents reported generally consistent adoption of proper hygiene practices, with an overall mean of 4.16. Proper and systematic household waste disposal received the highest mean (M = 4.27), followed by not sharing personal hygiene items (M = 4.24) and consistent use of safe drinking water (M = 4.23).

Regular bathing and toothbrushing (M = 4.17), handwashing before meals and after toilet use (M = 4.16), following sanitation guidance (M = 4.13), and using soap and water for handwashing (M = 4.12) were likewise rated positively. Regular reminders within the household received the lowest mean (M = 4.07), while participation in community hygiene programs obtained M = 4.09.

4.3 Reported Diarrhea Occurrence and Its Relationship With WaSH Conditions

The overall mean for reported diarrhea occurrence was 1.78, interpreted in the source instrument as never. This result should not be read as the complete absence of diarrhea. The item asking whether at least one household member had experienced diarrhea during the previous month received the highest mean of 1.89, corresponding to rarely.

Diarrhea after consuming food outside the home received a mean of 1.84, while an observed increase in household diarrhea cases received 1.81. Multiple cases within a single month, episodes lasting more than two days, and reliance on home remedies each received a mean of 1.72. Medical consultation for severe diarrhea and diarrhea after drinking from the usual household source each obtained a mean of 1.77. The results therefore indicate infrequent self-reported household experiences rather than an epidemiologically measured incidence rate.

Table 2 presents the relationships between the WaSH dimensions and reported diarrhea occurrence.

Table 2. *Relationship Between WaSH Conditions and Reported Diarrhea Occurrence*

WaSH dimension	Pearson r	p value	Statistical decision
Clean-water availability	.046	.579	Not significant
Toilet and handwashing accessibility	-.001	.986	Not significant
Proper hygiene practices	-.165	.044	Significant
Overall WaSH rating	-.067	.417	Not significant

Note. Statistical significance was evaluated at alpha = .05.

Only proper hygiene practices demonstrated a statistically significant relationship with reported diarrhea occurrence, r = -.165, p = .044. The negative coefficient indicates that higher hygiene-practice scores were associated with lower reported diarrhea frequency. The relationship was weak. The squared correlation was approximately .027, indicating that hygiene-practice scores shared only about 2.7% of their variance with reported diarrhea occurrence. The finding therefore identifies a limited association rather than a strong predictive or causal effect.

Clean-water availability was not significantly associated with reported diarrhea, r = .046, p = .579. Toilet and handwashing accessibility was likewise unrelated to diarrhea frequency, r = -.001, p = .986. The overall WaSH score was also nonsignificant, r = -.067, p = .417. These results do not demonstrate that water and sanitation are unimportant; they show only that differences in respondents' reported scores did not correspond statistically with differences in reported diarrhea in this sample.

4.4 Differences in WaSH Conditions Across Respondent Groups

The original analysis compared WaSH scores across sex, age, monthly household income, length of residence, educational attainment, and barangay. Table 3 consolidates the reported probability values.

Table 3. *Summary of Group Differences in WaSH Conditions*

Grouping variable	Clean-water availability	Toilet/handwashing accessibility	Proper hygiene practices
Sex	.704	.333	.065
Age	.961	.648	.672
Monthly household income	.384	.510	.023*
Length of residence	.351	.378	.137
Educational attainment	.552	.626	.006*
Barangay	.174	.001*	.001*

Note. * p < .05. The source table labeled p = .023 for monthly household income as nonsignificant; this article applies the stated alpha = .05 criterion and treats the result as significant. Test statistics and post hoc comparisons were not available in the archived manuscript.

Clean-Water Availability

No statistically significant differences in clean-water availability were observed across sex, age, household income, length of residence, educational attainment, or barangay. Mean scores remained generally close to 4.00. Males reported M = 3.98 and females M = 4.02. Barangay means ranged from 3.90 in Barangay 501 to 4.08 in Barangay 497. The absence of significant differences suggests comparatively uniform perceived access across the sampled groups, although it does not establish uniform microbiological or chemical water quality.

Toilet and Handwashing Accessibility

No significant differences were found according to sex, age, income, residence length, or educational attainment. Barangay was the only significant grouping variable, p = .001. Barangay 496 obtained the highest mean accessibility score (M = 3.14, SD = 0.72), followed by Barangay 501 (M = 2.66, SD = 0.42), while Barangay 497 obtained the lowest mean (M = 2.42, SD = 0.52). Because post hoc comparisons were not reported, the analysis does not identify which specific barangay pairs differed significantly.

Proper Hygiene Practices

Hygiene-practice scores did not significantly differ according to sex, age, or length of residence. Sex approached but did not reach statistical significance, p = .065; females reported a higher mean (M = 4.22) than males (M = 4.06).

Significant differences were reported according to monthly household income, p = .023; educational attainment, p = .006; and barangay, p = .001. Respondents earning more than ₱21,000 had the highest income-group mean (M = 4.36), while those earning ₱6,000-₱10,000 had the lowest (M = 3.98). The pattern was not strictly linear.

For education, the highest descriptive means were reported among respondents with elementary education (M = 4.78) and no formal education (M = 4.67), whereas vocationally educated respondents (M = 3.88) and postgraduate respondents (M = 3.90) obtained the lowest means. These patterns require caution because the no-formal-education group contained only three respondents and the postgraduate group only two. Barangay 501 obtained the highest hygiene-practice mean (M = 4.43), followed by Barangay 496 (M = 4.08) and Barangay 497 (M = 3.97). Without post hoc results, specific pairwise differences cannot be established.

4.5 Discussion

The findings present a differentiated picture of WaSH conditions in the selected barangays. Household water supply, private toilets, private handwashing stations, and personal hygiene practices were generally rated favorably. Public toilets and public handwashing stations, however, were consistently rated poorly. The principal concern was therefore not the complete absence of household infrastructure but an imbalance between private household conditions and the sanitation environment available in public spaces.

This distinction is important in urban public health. Household facilities may protect residents while at home, but daily activities occur in markets, streets, workplaces, transport areas, schools, and other shared locations. Deficient public sanitation can create exposure pathways that household-level measures do not address. Haque and Freeman (2021) argued that effective WaSH systems require functionality, maintenance, and integration into routine service delivery rather than infrastructure installation alone. The poor ratings for public facilities are consistent with this implementation perspective.

The favorable ratings for household water supply may help explain why water availability did not demonstrate a significant relationship with reported diarrhea. Most respondents reported relatively high and similar water-access scores, producing limited variability. When scores cluster near the upper end of a scale, statistical relationships become more difficult to detect. Moreover, perceived access and reliability do not establish microbiological safety because the study did not conduct laboratory water testing.

Local environmental-health research likewise illustrates the value of complementing perception-based assessments with objective contamination monitoring, including the use of edible aquatic vegetation as a biomonitor of urban-waterway conditions and associated food-safety risks (Ylagan et al., 2025).

A similar limitation applies to toilet and handwashing accessibility. The composite combined favorable household facilities with poorly rated public facilities. Aggregating these contrasting conditions may have weakened the interpretability of the overall score. A household may report excellent private sanitation but limited access to public toilets, creating a moderate composite that represents two fundamentally different circumstances.

The weak negative relationship between hygiene practices and reported diarrhea is directionally consistent with prior evidence that handwashing, safe-water handling, waste disposal, and personal cleanliness can interrupt fecal-oral transmission (Toney-Butler et al., 2023; Wolf et al., 2022). Nevertheless, the coefficient was small and close to the .05 threshold. It should not be interpreted as evidence that hygiene practices independently caused lower diarrhea occurrence. Diarrhea has multiple potential sources, including contaminated food outside the home, viral transmission, parasitic infection, medication, underlying disease, and exposures not measured by the questionnaire.

The comparatively higher score for diarrhea following food consumed outside the home supports the possibility that some episodes arose from factors beyond domestic WaSH conditions.

Related Philippine seafood-safety evidence has documented microplastic contamination and bacterial isolates in a commonly consumed fish species, illustrating that exposure pathways may also arise through food systems beyond the household WaSH environment (Nacino & Basit, 2025).

The low overall diarrhea score may also have produced a floor effect. Most respondents selected never or rarely, restricting variation in the outcome measure and reducing the capacity of correlation analysis to detect associations. This may partly explain why clean-water and sanitation scores were not significantly related to reported diarrhea.

The significant geographic variation in sanitation accessibility is among the most policy-relevant findings. Barangay 496 recorded a higher mean than Barangays 501 and 497, indicating that the availability and usability of toilets and handwashing stations were not uniform across adjacent communities. Tseole et al. (2022) emphasized that local engagement, maintenance, funding, and monitoring influence whether WaSH facilities remain operational. The barangay-level differences observed here are consistent with the proposition that implementation quality is geographically contingent.

Hygiene-practice differences according to barangay similarly suggest that behavior occurs within a local institutional and social context. Barangay programs, health-worker communication, community clean-up activities, enforcement of sanitation ordinances, and access to hygiene resources may vary by locality. However, the study did not directly measure these mechanisms, and local governance should therefore be treated as a possible explanation rather than an established cause.

The significant result for educational attainment should be interpreted conservatively. The highest means occurred among groups with little or no formal education, contrary to the conventional expectation that greater educational attainment produces stronger health knowledge and practice. The result may reflect very small subgroup sizes, differential response tendencies, barangay-level exposure, or social-desirability bias. Kabir et al. (2021) noted that hygiene practices are learned through family and school contexts, suggesting that formal educational attainment is not the only route through which hygiene behavior develops.

Monthly household income also produced a significant overall difference in hygiene practices when the reported p value of .023 is interpreted using the stated alpha = .05 criterion. The pattern was not linear: although the highest-income group obtained the highest mean, the lowest-income group also reported relatively favorable hygiene scores. Post hoc analysis is required before identifying which income groups differed.

Overall, the results support an integrated but differentiated WaSH strategy. Household hygiene behavior remains relevant because it showed the only significant relationship with reported diarrhea occurrence. At the same time, the weak magnitude of the relationship and the poor condition of public sanitation facilities indicate that behavior change should not substitute for infrastructure investment. Sustainable community health requires reliable water services, maintained and inclusive sanitation facilities, access to soap and water, food-safety measures, and continuing hygiene education.

The findings are subject to several limitations. The cross-sectional design precludes causal inference. All substantive measures were self-reported and may be affected by recall and social-desirability bias. Diarrhea was not clinically verified, and water quality was not objectively tested. Psychometric indices for the locally developed questionnaire were unavailable. The analysis was limited to three purposively selected barangays, and some educational subgroups were extremely small. In addition, the archived paper did not preserve test statistics, assumption checks, or post hoc comparisons for multi-category group differences. These limitations constrain generalizability and the precision of inferential interpretation.

5. Conclusions, Recommendations, and Implications

5.1 Conclusions

The study examined household water, sanitation, and hygiene conditions and their relationship with reported diarrhea occurrence among 150 adult residents of Barangays 496, 497, and 501 in Sampaloc, Manila. The findings indicate that the WaSH situation cannot be characterized uniformly: household-level conditions were generally favorable, while public sanitation infrastructure remained inadequate.

Respondents reported reliable household water access, with positive assessments of supply consistency, sufficiency, pressure, and ability to meet daily needs. Clean-water availability did not differ significantly according to sex, age, monthly household income, length of residence, educational attainment, or barangay. Lower ratings for maintenance, upgrading, and responsiveness to interruptions nevertheless indicate areas requiring service-management improvement.

Most respondents reported access to functional private toilets and household handwashing stations supplied with water and soap. In contrast, public toilets and public handwashing facilities were rated poorly in location, maintenance, availability of water and soap, affordability, waiting time, signage, and accessibility for older persons and persons with disabilities. Favorable household conditions therefore did not extend consistently to the public environment.

Proper hygiene practices were generally high. Safe drinking-water use, waste disposal, personal hygiene, handwashing, surface cleaning, and avoidance of sharing personal items were commonly reported. Reported diarrhea occurrence was low, but the results represent self-reported frequency rather than epidemiologically measured incidence.

Among the WaSH dimensions, only hygiene practices demonstrated a statistically significant relationship with reported diarrhea occurrence. The negative relationship was weak, $r = -.165$, and explained only a small proportion of variation. Clean-water availability, toilet and handwashing accessibility, and the overall WaSH rating were not significantly associated with reported diarrhea.

Toilet and handwashing accessibility differed significantly by barangay. Hygiene practices differed significantly by monthly household income, educational attainment, and barangay, although the education findings require caution because of very small subgroup sizes. Overall, the results indicate that effective WaSH implementation requires a combined strategy involving household behavior, public infrastructure, inclusive facility design, responsive service management, food-safety measures, and barangay-specific interventions.

5.2 Recommendations

5.2.1 Improve Public Toilets and Handwashing Facilities

The City Government of Manila and the concerned barangay governments should prioritize the rehabilitation, installation, and maintenance of public toilets and handwashing stations in high-traffic areas such as barangay halls, health centers, markets, transport points, and community centers. Facilities should have continuous water, adequate soap, regular cleaning and disinfection, appropriate waste disposal, clear signage, sufficient lighting, and documented inspection schedules. Barangay 497 should receive priority because it recorded the lowest sanitation-accessibility and hygiene-practice means.

5.2.2 Adopt Inclusive Sanitation Design

Public sanitation facilities should accommodate older persons, persons with disabilities, children, pregnant women, and individuals with limited mobility. Improvements should include ramps, handrails, wider entryways, nonslip flooring, accessible toilet heights, adequate interior space, and clear signage. Accessibility audits should include direct participation by older residents and persons with disabilities.

5.2.3 Sustain Household Hygiene Education

Barangay health workers, health centers, schools, and community organizations should continue hygiene-promotion activities emphasizing handwashing with soap, safe drinking-water storage, proper waste disposal, sanitation during water interruptions, food hygiene, and early recognition of dehydration. The weak but significant hygiene-diarrhea relationship supports continued education, but behavior-change programs should be paired with infrastructure and service improvements.

5.2.4 Strengthen Food-Safety Measures

Because diarrhea following food consumed outside the home received one of the higher frequency scores, local authorities should strengthen inspection and training for eateries, street-food vendors, canteens, and informal food establishments. Monitoring should address water sources, handwashing, utensil sanitation, temperature control, food storage, waste management, and reporting of suspected foodborne illness.

5.2.5 Improve Water-Service Communication and Responsiveness

Barangay officials and the water-service provider should establish accessible channels for reporting interruptions, low pressure, suspected contamination, and infrastructure damage. Residents should receive timely information on scheduled maintenance, expected response times, alternative water-distribution arrangements, and precautionary measures following service restoration.

5.2.6 Use Barangay-Specific WaSH Planning

Each barangay should maintain a localized WaSH profile covering the number and condition of public toilets and handwashing stations, availability of water and soap, accessibility for vulnerable populations, inspection frequency, sanitation complaints, participation in hygiene programs, and reported diarrhea or foodborne-disease cases. Resource allocation should be based on identified deficiencies rather than uniform distribution without regard to local need.

5.2.7 Strengthen Monitoring and Evaluation

Local government and health authorities should develop measurable indicators for facility functionality, water and soap availability, cleaning frequency, repair response time, accessibility compliance, community utilization, and reported health outcomes. A barangay WaSH monitoring team may include barangay officials, health workers, sanitation inspectors, community representatives, older residents, and persons with disabilities. An integrated analytics approach could further strengthen barangay WaSH governance by connecting facility functionality, supply availability, maintenance responsiveness, program participation, and reported health outcomes within a common decision-support framework (Atento et al., 2025).

5.2.8 Directions for Future Research

Future studies should use longitudinal or intervention designs; include objective water-quality testing and, where feasible, clinically verified diarrhea outcomes; separate private and public sanitation indicators; report complete instrument validation and reliability; apply and report appropriate omnibus tests, effect sizes, assumption checks, and post hoc comparisons; enlarge small demographic subgroups; examine food handling, household crowding, water storage, and age of affected household members; and replicate the study in other districts of Manila.

5.3 Implications of the Study

Practical Implications

WaSH planning should not rely solely on household access statistics. A community may report adequate private toilets, handwashing stations, and water connections while still lacking functional public sanitation. Health assessments should therefore distinguish household conditions from public-environment conditions. Hygiene promotion remains relevant, but the weak association with diarrhea demonstrates that behavior change alone is insufficient.

Institutional Implications

Barangay governments and local health institutions should adopt evidence-based, locality-specific WaSH management. Differences among barangays suggest that implementation quality, maintenance, resource availability, and community engagement may vary substantially within a limited geographic area. Clear accountability is required for maintenance, supply replenishment, inspection, accessibility compliance, and response to complaints.

Policy Implications

Local policies should treat accessible public sanitation as an essential urban service and prescribe minimum standards for location, cleanliness, water supply, soap availability, disability access, inspection, and maintenance. Policy evaluation should move beyond counting facilities because damaged, inaccessible, or unequipped facilities do not constitute effective access. Barangay differences support needs-based resource allocation.

Methodological Implications

The study illustrates the limitations of combining distinct WaSH components into one composite score. Future measurement should distinguish household from public sanitation, facility presence from functionality, perceived access from objective water quality, hygiene knowledge from behavior, and self-reported diarrhea frequency from confirmed incidence. Complete reporting of test statistics, effect sizes, subgroup sizes, assumption checks, and post hoc analyses is also essential.

Scholarly and Community-Health Implications

The study contributes localized evidence from a dense urban Philippine setting. It demonstrates that WaSH challenges may persist not because households entirely lack basic services but because public facilities, inclusive access, service management, and behavioral consistency remain uneven. Diarrhea prevention is therefore shaped by household practices, infrastructure, community environments, food systems, local governance, and service responsiveness.

6. References

Atento, R. G., Quinto, L., Espelita, C. A. M., & Castaneda, C. (2025). Integrating business and health analytics: A conceptual framework for dual outcomes in healthcare. *International Journal of Health & Business Analytics, 1*(1). https://doi.org/10.65166/04pdc866

Haque, S. S., & Freeman, M. C. (2021). The applications of implementation science in water, sanitation, and hygiene (WASH) research and practice. *Environmental Health Perspectives, 129*(6), 065002. https://doi.org/10.1289/EHP7762

John, C. K., & Ajibade, F. O. (2024). Exploring the dynamics of WASH services: Challenges, enablers, and strategies for improvement. *Discover Civil Engineering, 1*, Article 79. https://doi.org/10.1007/s44290-024-00085-9

Kabir, A., Roy, S., Begum, K., Kabir, A. H., & Miah, M. S. (2021). Factors influencing sanitation and hygiene practices among students in a public university in Bangladesh. *PLOS ONE, 16*(9), e0257663. https://doi.org/10.1371/journal.pone.0257663

Ko, S. H., & Sakai, H. (2022). Water sanitation, hygiene and the prevalence of diarrhea in the rural areas of the delta region of Myanmar. *Journal of Water and Health, 20*(1), 149-156. https://doi.org/10.2166/wh.2021.192

Kumwenda, S. (2019). Challenges to hygiene improvement in developing countries. In *The relevance of hygiene to health in developing countries*. IntechOpen. https://doi.org/10.5772/intechopen.80355

McMichael, C. (2019). Water, sanitation and hygiene (WASH) in schools in low-income countries: A review of evidence of impact. *International Journal of Environmental Research and Public Health, 16*(3), 359. https://doi.org/10.3390/ijerph16030359

Meisenheimer, E. S., Epstein, C., & Thiel, D. (2022). Acute diarrhea in adults. *American Family Physician, 106*(1), 72-80. https://www.aafp.org/pubs/afp/issues/2022/0700/acute-diarrhea.html

Nacino, G. E., & Basit, S. A. (2025). Microplastics, bacterial isolates, and antimicrobial resistance profiles in *Decapterus macrosoma* from Cavite, Philippines. *International Journal of Health & Business Analytics, 1*(2). https://doi.org/10.65166/bevs3330

Prüss-Ustün, A., Wolf, J., Bartram, J., Clasen, T., Cumming, O., Freeman, M. C., Gordon, B., Hunter, P. R., Medlicott, K., & Johnston, R. (2019). Burden of disease from inadequate water, sanitation and hygiene for selected adverse health outcomes: An updated analysis with a focus on low- and middle-income countries. *International Journal of Hygiene and Environmental Health, 222*(5), 765-777. https://doi.org/10.1016/j.ijheh.2019.05.004

Quinto, L., & Atento, R. G. (2025). Economic growth and developmental equity in four ASEAN economies: Linking macroeconomic trends to employment and child nutrition (1999–2024). *International Journal of Health & Business Analytics, 1*(1). https://doi.org/10.65166/nq75nv94

Republic Act No. 10173, Data Privacy Act of 2012 (Philippines). https://privacy.gov.ph/data-privacy-act/

Temporada, K., Quinto, L., Tarraya, D. A., Sison, F. C., Marfil, J. F., Ramirez, C., & Ng, W. J. (2025). Awareness and preventive practices on leptospirosis in flood-prone communities of Marikina City, Philippines. *International Journal of Health & Business Analytics, 1*(1). https://doi.org/10.65166/x71zvx65

Toney-Butler, T. J., Gasner, A., & Carver, N. (2023). Hand hygiene. In *StatPearls*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK470254/

Tseole, N. P., Mindu, T., Kalinda, C., & Chimbari, M. J. (2022). Barriers and facilitators to water, sanitation and hygiene practices in Southern Africa: A scoping review. *PLOS ONE, 17*(8), e0271726. https://doi.org/10.1371/journal.pone.0271726

UNICEF Philippines. (2017, July 17). *Two billion people lack safe drinking water, more than twice lack safe sanitation*. https://www.unicef.org/philippines/press-releases/two-billion-people-lack-safe-drinking-water-more-twice-lack-safe-sanitation

Wolf, J., Hubbard, S., Brauer, M., Ambelu, A., Arnold, B. F., Bain, R., Bauza, V., Brown, J., Caruso, B. A., Clasen, T., Colford, J. M., Jr., Freeman, M. C., Gordon, B., Johnston, R. B., Mertens, A., Prüss-Ustün, A., Ross, I., Stanaway, J., Zhao, J. T., & Boisson, S. (2022). Effectiveness of interventions to improve drinking water,

sanitation, and handwashing with soap on risk of diarrhoeal disease in children in low-income and middle-income settings: A systematic review and meta-analysis. *The Lancet, 400*(10345), 48-59. https://doi.org/10.1016/S0140-6736(22)00937-0

Ylagan, H. M., Aguirre, K. A. G. C., Briones, L. A., Briones, P. N. P., Canapi, C. V. T., Corpuz, K. M. R., Esmelo, A. J. M., Ganacial, V. J. M., Gasid, K. M. M., Ledesma, A. F. P., Marasigan, K. V. O., Miraples, M. B., Santos, E. G. D., Valdez, J. F. L., & Quinto, L. F. (2025). Post-rehabilitation heavy metal contamination analysis of kangkong (*Ipomoea aquatica*) cultivated in the Pasig River Waterway, Manggahan Floodway. *International Journal of Health & Business Analytics, 1*(2). https://doi.org/10.65166/xf4mm102