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Utilization of Environmental Sanitation and Personal Hand Hygiene Mitigation in Health Facilities to Prevent Control Waterborne Diseases in Nyabihu District, Rwanda

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ABSTRACT

Globally, regionally, and locally in Rwanda, Water-borne diseases remain a major public health concern in rural Rwanda, where poor water, sanitation, and hygiene (WASH) contribute to high rates of diarrheal illness and intestinal parasite infection. Between July 2024 and June 2025, health centers in Nyabihu District reported 8,086 episodes of diarrhea and 32,838 cases of intestinal parasites, despite government and partner WASH programs. Yet little is documented about why visitors to public health facilities do or do not use the hygiene and sanitation measures provided in Nyabihu District. This study therefore determined Utilization of Environmental Sanitation and Personal Hand Hygiene Mitigation and their knowledge, attitude and practices in Health Facilities to Prevent Control Water Borne Disease in Nyabihu District, Rwanda Study a mixed-methods, cross-sectional descriptive design was used. A sample of 283 facility visitors was selected by stratified random sampling (Yamane, 1967), complemented by key informant interviews, focus group discussions, and observation checklists; data were analyzed in SPSS using descriptive statistics and chi-square tests, and qualitative data were analyzed thematically. Ethical approval was obtained from Mount Kigali University and permission from Nyabihu District. Results on age: most were 60% (170), and the least were aged 19 (6.7%) and 65 – 99 years, with an age range of 87 years in the utilization of hand hygiene and sanitation, with a significant contribution of chi-square. 10.22, and P values of 0.026 for prevention and control of waterborne disease and cross-infection. Gender, females participated more than males in this study at 151 (53.4%), males 129 (45.6%) with significant contribution of P values 0.0134 prevention and control of waterborne disease and cross-infection. Most population health 219; (77.4%) utilized hand hygiene and sanitation mitigations after visiting toilet/ improved pit latrine during the health center visit, 50(17.7%) did not used hand hygiene measures after visiting toilet / improved latrine at that time,14(4.9%) sometimes used the pit latrine and sometimes bushes for short calls, with significant contribution of hygiene and environmental sanitation of P values of. 0.0123 in prevention and control of waterborne diseases and cross-infections. That most health facility, 218(77%) had wet running tap water at hand washing station, 44(15.5) whiles few facilities 21(7.4%) regular water supply/availability of water.127 (44.9%). Regarding knowledge, the majority, 105 (37.1%), are aware that Diarrhea, Cholera, Intestinal worms diseases can be prevented and controlled by handwashing. 84(29.7%) know diarrhea only as wash related diseases, 43(15.2%) cholera only, 40(14.1) intestinal worms only. Regarding attitudes towards the utilization of hand hygiene and environmental sanitation, most participants, 137(48.4%) agreed that handwashing with soap is important at health centers, The study

concludes that low utilization of hygiene and sanitation practices among visitors to public health centers in Nyabihu District is mainly due to inadequate infrastructure and poor maintenance rather than limited of awareness, as visitors understand the importance of hygiene but are hindered by the absence of water, soap, clean toilets, by inadequate infrastructure and poor maintenance rather than lack of awareness: visitors understand the importance of hygiene but are hindered by the absence of water, soap, clean toilets and staff guidance.

Keywords: Hand hygiene, Environmental sanitation, Water-borne diseases, Cross-infection

1.1 Introduction and Background

Infectious diseases remain a considerable public health challenge in Rwanda and worldwide, especially in rural areas where water, sanitation and hygiene (WASH) infrastructure and practices are often insufficient. Access to potable water, adequate sanitation and hygiene practices such as handwashing are essential for preventing and controlling diarrhoeal diseases, soil-transmitted helminthiases, schistosomiasis, typhoid, cholera, and respiratory infections (Nshimiyimana et al., 2025). Improved sanitation and hygiene, including clean latrines, regular handwashing with soap, safe water handling and hygiene education, markedly reduce the transmission of these infections, and in Rwanda poor sanitation and unsafe water are linked to recurrent infection (Staudacher et al., 2014; Uwimpuhwe et al., 2014).

Rwanda has prioritised WASH as a key public health strategy through national health promotion and community-based programmes, including the Community Hygiene Clubs, which evaluations show have improved household WASH behaviour and reduced WASH-related illness (Ntakarutimana et al., 2022). However, these programmes focus largely on supply-side interventions such as latrine construction and behaviour change promotion. Only 64% of the rural population has access to basic sanitation, and in Nyabihu District 69.2% of households use improved water sources, with wide variation between sectors (UNICEF, 2023). Evidence on whether visitors to public health centres actually use the hygiene and sanitation measures available to them remains limited.

Studies in Rwanda and comparable settings identify several influences on hygiene practice: knowledge and perception, physical infrastructure, socio-economic constraints, forgetfulness and low perceived risk, and cultural and social norms. In Southern Rwanda, for example, nearly 88% of people knew how to wash their hands, but lack of soap, water and handwashing stations limited practice (Ntakirutimana et al., 2020). Among hospital patients and visitors, attention, memory and environmental context were barriers to hand hygiene (Gaube et al., 2021). Nyabihu District adds its own challenges of rough terrain, uneven water supply, limited resources and differences in health education, and little has been published on it specifically.

The Health Management Information System (HMIS) reported 8,086 episodes of diarrhoea and 32,838 cases of intestinal parasites in Nyabihu health centres between July 2024 and June 2025, suggesting that available hygiene and sanitation interventions are not being used effectively. Public health centres are critical entry points for prevention and treatment, so poor hygiene practice there can sustain transmission within facilities and communities. This study therefore sought to determine the factors contributing to the utilization of quality hand hygiene and environmental sanitation mitigations to prevent and control water-borne diseases and cross-infections among visitors to public health facilities in Nyabihu District. Its specific objectives were to determine (i) the level of utilization of hand hygiene and environmental

sanitation, (ii) the contribution of knowledge, attitudes and practices (KAP), (iii) the accessibility of water, soap, toilets, handwashing stations and cleanliness, and (iv) the contribution of health system factors.

2.0 Material and Methods

2.1 Material

2.1.1 Level of Utilization of Hand Hygiene and Environmental Sanitation

About 4.6 billion people, or 57% of the world's population, had access to a safely managed sanitation service in 2022. More than 1.5 billion people still lacked even the most basic sanitation amenities, including private restrooms or latrines, in spite of these advancements. Of these, 419 million people still defecate in the open, frequently under bushes, in city gutters, or straight into open water sources(United Nations Children's Fund & World Health Organisation, 2023).

The problem of global sanitation is not limited to toilet availability. In 2020, 44% of all wastewater generated by households globally was released into the environment without any kind of safe treatment. In addition to contaminating ecosystems, this untreated effluent poses major health concerns to the general public. The risk of exposure to dangerous diseases and pollutants is increased by the startling estimate that at least 10% of the world's population eats food that has been irrigated with wastewater(UNICEF & WHO, 2020).

Even with significant advancements, billions of people still do not have access to clean drinking water, sanitary facilities, or proper hygiene. It is necessary to significantly accelerate present worldwide rates of progress six times for drinking water, five times for sanitation, and three times for hygiene in order to achieve universal coverage by 2030. Water stress and scarcity are still issues in many places of the world, despite a 9% increase in water use efficiency. The number of people living in water-stressed countries was 2.4 billion in 2020. Climate change and conflicts exacerbate the problem(Franzke, 2025).

Globally, inadequate water use led to 502,000 deaths out of 1.50 million diarrheal deaths in 2012, while inadequate sanitation practices caused 280,000 deaths. Together, these factors contributed to 685,000 deaths(Okesanya et al., 2024). Around the world, 51% of healthcare institutions provide a minimum hygiene service, which included having operational handwashing stations at points of care and within five meters of restrooms. Only one-third (37%) of healthcare institutions in sub-Saharan Africa had handwashing stations with soap and water at the toilet, whereas three-quarters (73%) of them had hand hygiene facilities at sites of treatment(WHO, 2022).

According to a Water Aid-commissioned analysis based on recent World Bank methodology, there were an anticipated 2.6 million HCAI cases in seven African nations: (Ethiopia, Ghana, Malawi, Mali, Nigeria,Uganda and Zambia), with a combined population of 472 million in 2022 (at least 50% of which are thought to be antibiotic-resistant), leading to 277,160 unnecessary deaths(Water aid, 2023).

The 2022 Population and Housing Census (PHC) found that 82% of Rwandan households (96 percent in urban areas and 77% in rural ones) used water from improved sources for drinking water, such as piped water, protected dug wells, protected springs, boreholes or tube wells, rainwater, and packaged or delivered water. Approximately 18% of the households drew their water from unimproved sources(Survey, 2022).

In South Africa, almost 18 million people lack access to proper sanitation. Many emerging nations face this issue, which is not specific to South Africa(Phaswana-Mafuya & Shukla, 2005).

The MAHAMA refugees/Kirehe District camp's medical facilities noticed a rise in the prevalence of a feverish ailment among camp residents starting in late October 2015. On December 1, 2015, the Ministry

of Health (MOH) confirmed an outbreak of typhoid fever after conducting an investigation in coordination with the Ministry of Disaster Management and Refugee Affairs (MIDIMAR) and other partners operating in the camp. There were an estimated 1663 cases recorded as of the end of January 2016(Nahimana et al., 2017).

The bacteria Salmonella enterica serotype Typhi is the cause of typhoid fever and is spread by consuming food and water tainted by the excrement and urine of patients or bacterium carriers who do not exhibit any symptoms. According to the DHS 2019-2020 Survey, households report their water source, the sanitary services they utilize, and the availability of handwashing stations. Starting with no service, this data can be mapped into "ladders," progressing through restricted service, basic service, safe provision, and unimproved service. Each step of these ladders' proportions of households are weighted averaged by the indices. Given that both the water and sanitation progress indices are near 65% as of 2020, one might argue that Rwanda is 65% of the way to universal access to clean water and sanitary facilities(Aceh, 2020).

To better comprehend the study's background and focus, it is important to clarify several key terminologies used in this research:

Utilization**:** In public health contexts, utilization refers to the extent to which individuals use available sanitation and hygiene facilities or adopt recommended health-related behaviors (Andersen, 1995). It reflects both access to services and the behavioral decision to use them.

Hygiene measures: These refer to practices such as handwashing with soap, food safety, and personal hygiene behaviors that support health maintenance and illness prevention. Hand hygiene, in particular, is recognized as one of the most effective measures for preventing infectious disease transmission (World Health Organization [WHO], 2019).

Sanitation measures: These include procedures and systems related to the safe disposal of human waste, wastewater, and other waste materials to ensure a healthy living and healthcare environment. Adequate sanitation has been strongly linked to reductions in diarrheal diseases and other communicable infections (UNICEF & WHO, 2021).

Infectious diseases**:** These are illnesses caused by pathogenic microorganisms such as bacteria, viruses, parasites, or fungi that can be transmitted directly or indirectly from one person to another (World Health Organization, 2020).

Reviewing existing literature is crucial for several reasons. First, it facilitates the identification of knowledge gaps in previous studies, particularly those related to health facility settings in rural and semi-urban areas such as Nyabihu District. Evidence indicates that disparities in WASH service access and utilization are more pronounced in rural health facilities compared to urban areas (WHO & UNICEF, 2021). Second, a literature review provides both empirical and theoretical frameworks that guide the construction of the present study. Behavioral theories, such as the Health Belief Model and Andersen's Behavioral Model of Health Services Utilization, suggest that infrastructure, cultural attitudes, perceived susceptibility, knowledge levels, and access to clean water significantly influence sanitation and hygiene practices (Andersen, 1995; Glanz, Rimer, & Viswanath, 2015).

Furthermore, reviewing prior studies helps inform evidence-based strategies and policy recommendations aimed at improving public health interventions and outcomes. Global evidence shows that integrated WASH interventions combining infrastructure development and behavior change communication are more effective than supply-side interventions alone (Freeman et al., 2017). Therefore, this literature analysis seeks to identify trends, best practices, challenges, and lessons learned from comparable settings to provide a strong foundation for analyzing the specific circumstances in Nyabihu District. To ensure a

comprehensive and balanced understanding of the topic, the review draws from both national and international literature

2.1.2 Knowledge, Attitudes and Practices, Infrastructure and Health System Factors

Utilization of sanitation and hygiene measures is strongly influenced by the knowledge and attitudes of the general public as well as health professionals. According to a cross-sectional survey of healthcare workers in Rwanda's Karongi District, there is a somewhat lower level of excellent practice (≈63.3%) but high levels of knowledge (≈78.6%) and favorable attitudes (≈79.5%) regarding infection prevention and control. Higher education, more job experience, being older (over 45), and possessing a good attitude and high level of expertise were all factors linked to improved practice. This implies that inadequate or subpar behavior teaching or reinforcement is frequently a contributing factor in practice gaps(Theogene Uwizeyimana et al., 2021).

A recently published study (2025) on healthcare providers' knowledge and practices regarding nosocomial infection prevention in Rwandan public hospitals also highlighted that low adherence to universal precautions, limited access to personal protective equipment (PPE), and a lack of continuous training all contribute to providers' lower use of hygiene and sanitation measures
(Pierre et al., 2025).

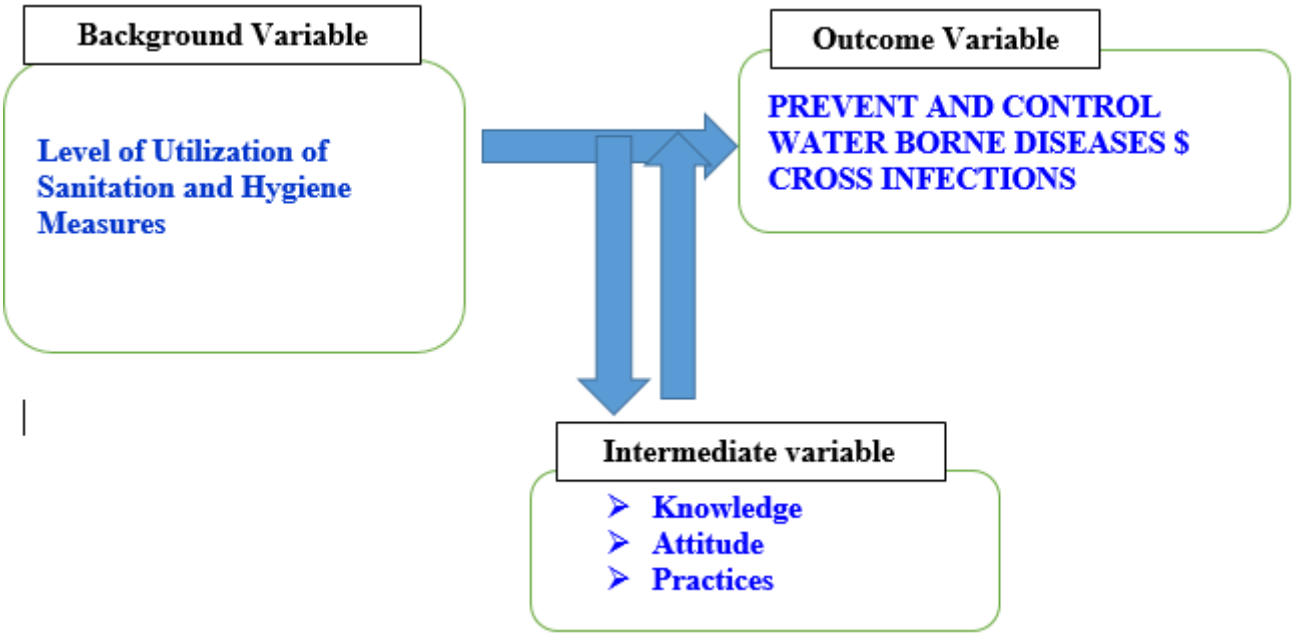
2.2 Theoretical Framework

The study drew on the Health Belief Model (HBM), the Theory of Planned Behavior (TPB), the Health Action Process Approach (HAPA) and Social Cognitive Theory (SCT), within a socio-ecological perspective. The HBM explains hygiene behaviour through perceived susceptibility, severity, benefits and barriers, cues to action and self-efficacy, and has been used to explain diarrhoeal disease dynamics in Uganda (Kankya et al., 2022). The TPB holds that attitudes, subjective norms and perceived behavioural control shape intention and behaviour, and it has predicted open-defecation-free behaviour in Ghana (Nnindini & Dankwah, 2023) and caterers' hand hygiene (Clayton & Griffith, 2008). HAPA adds a volitional phase of planning and action control that addresses the intention–behaviour gap, and TPB and HAPA together captured hand hygiene determinants among hospital patients and visitors (Gaube et al., 2021). SCT emphasises the interplay of personal beliefs, self-efficacy, observational learning and environmental supports, and predicted compliance with hygiene guidelines among food workers (Wang et al., 2023).

These perspectives were combined into the conceptual framework in Figure 1. Health system factors, accessibility to infrastructure and individual characteristics act on knowledge, attitudes and practices, which together determine the level of utilization of hand hygiene and environmental sanitation and, in turn, the prevention and control of water-borne diseases and cross-infections.

Figure 2.1 Conceptual frameworks Silali etal (2025)

2.3 Conceptual Framework



3.0 Methods

3.1 Study Design

This study used a mixed-methods, cross-sectional descriptive design. The quantitative component collected data from visitors at a single point in time using semi-structured questionnaires, describing current hygiene and sanitation practice and examining associations between utilization and its determinants, although such designs cannot establish causation. The qualitative component, through key informant interviews (KIIs), focus group discussions (FGDs) and observation, explained the context behind the figures. Triangulation across these sources strengthened the credibility of the findings

3.2 Study Area

The study was conducted in public health centres in Nyabihu District, Western Province, Rwanda. The district is predominantly rural, hilly and has dispersed settlement, which affects access to health services, water and sanitation. It has 12 sectors and, according to the 2022 Population and Housing Census, about 319,047 people, 75.5% of them rural (NISR, 2022). About 77.9% of households use improved drinking water sources (94.1% urban, 72.8% rural), while 22.1% still depend on unimproved sources. The district has a high prevalence of stunting among children under five, reflecting wider nutrition, hygiene and WASH challenges.

3.3 Study Population

The study population comprised adult patients and visitors attending Nyabihu District public health centres, an average of 962 patients per day in outpatient services. and health facility staff involved in sanitation and hygiene (two per health centre, about 34 in total) who were interviewed as key informants.

3.4 Sampling Techniques and Sample Size

Stratified random sampling, with health facilities as strata and simple random selection within each stratum, was used for the quantitative survey so that every eligible visitor had an equal chance of selection. Purposive sampling selected information-rich key informants, including health officers, environmental health officers, sanitation focal points, community health workers and facility administrators. The sample size was calculated with Yamane's (1967) formula, $n = N / (1 + Ne^2)$, with $N = 962$ and $e = 0.05$, giving

283 respondents. A 10% allowance for non-response (to 311) was planned; in the event all 283 sampled visitors completed the questionnaire.

3.5 Research Tools and Instruments

Data were collected with three instruments: a semi-structured questionnaire for visitors (closed and open-ended items on demographics, hygiene practice, knowledge, attitudes, infrastructure and health system factors); interview and FGD guides for health professionals, community health workers and facility administrators; and an observation checklist recording the presence and condition of handwashing stations, toilets, water supply and cleanliness.

3.6 Piloting, Validity and Reliability

All instruments were pre-tested in a health center outside the main study area. Content and face validity were reviewed by experts in research methodology and public health, and internal consistency was assessed with Cronbach's alpha, with 0.70 or higher considered acceptable.

3.7 Data Analysis

Quantitative data were coded and analyzed in the Statistical Package for the Social Sciences (SPSS) using frequencies, percentages, means and standard deviations, and chi-square tests for associations. Interview and FGD data were analyzed thematically, and quotations are reported with the date of the discussion.

3.8 Ethical Consideration

Ethical approval was obtained from the Mount Kigali University Institutional Review Board and permission from the Nyabihu District Office and the management of the participating health facilities. Participation was voluntary and free from coercion, informed consent was obtained from all participants, who could withdraw at any time without consequence, and confidentiality and anonymity were maintained by using codes and excluding personal identifiers. Data were stored securely and used only for research purposes.

4.0 Results and Findings

4.1 Response Rate and Demographic Profile

All 283 sampled respondents participated (response rate 100%). Females were slightly more numerous than males, 151 (53.4%) compared with 129 (45.6%). The largest age group, 170 respondents (60.1%), was aged 12–35 years, followed by 94 (33.2%) aged 36–65 years and 19 (6.7%) aged 65–99 years. Utilization differed significantly by age ($\chi^2 = 10.22$, $p = 0.026$) and by gender ($p = 0.0134$). Agriculture was the main occupation (50.5%), followed by trading (23.3%), student status (14.8%) and formal employment (10.6%), reflecting a largely rural, informally employed population. As one key informant explained:

"Most of people who come seeking medical are small scale farmers." KII held 10/5/2026.

4.1. Level of Utilization of Hand Hygiene and Environmental Sanitation to Prevention and Control of Waterborne Diseases and Cross-Infection

The results indicated that most population health 219 (77.4%) utilized hand hygiene and sanitation mitigations after visiting toilet/ improved pit latrine during the health centre visit, 50(17.7%) did not used hand hygiene measures after visiting toilet / improved latrine at that time,14(4.9%) sometimes used the pit latrine and sometimes bushes for short calls, with significant contribution of hygiene and environmental sanitation of P values of. 0.0123 in prevention and control of water borne diseases and cross-infections. Regarding hand hygiene most 126(44.5%) washed their hands with water and soap after toilet, least, 39(13.8%) did not wash their hands after toilet with frequency utilization contribution rage of 87 frequency

on prevention of waterborne disease and cross infections. This was also echoed during FGD discussions, who said:

"Sometime we have water in the tap to wash hand sometimes we miss water or soap" FGD held on 10/5/2026.

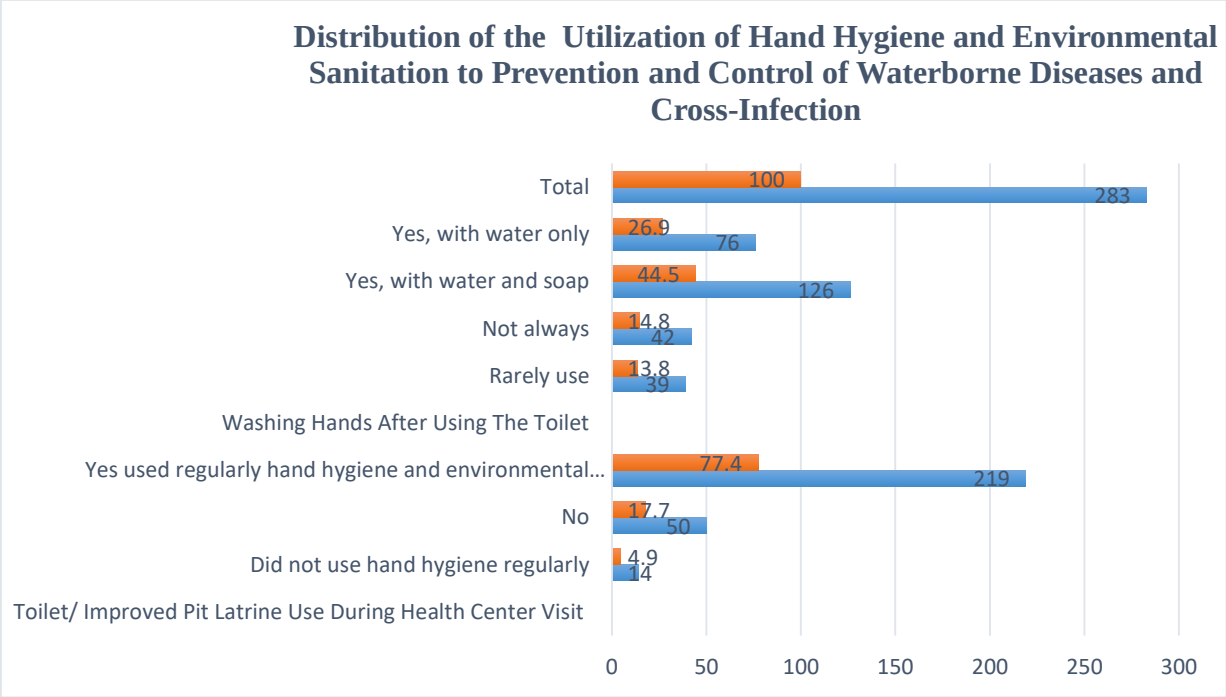


Figure 4.1: Distribution of the Utilization of Hand Hygiene and Environmental Sanitation to Prevention and Control of Waterborne Diseases and Cross-Infection

Regarding the Utilization of hand hygiene and environmental sanitation at Critical times/ before and after meals and visiting Latrine/toilets the results showed that most population health 140(49.5%) wash their hands after using the toilet, before eating, before preparing food, after cleaning a child.40 (14.1%) wash their hands right after toilet only, 35(12.4) wash their hands Before eating only, and15 (5.3%) did not wash their hands at any critical time, as shown in Table 4.1 below

Table 4.1 Wash hands at critical times

Hand washing with clean water and soap at critical times	Frequency (n)	Percentage (%)
After toilet	40	14.1
After toilet, before eating	15	5.3
After toilet, before eating, Before preparing food, after cleaning child	140	49.5
Before eating	35	12.4
None	15	5.3
Total	**283**	**100.0**

4.2 Knowledge, Attitudes, and Practices / KAP

Regarding knowledge, the majority, 105(37.1%), are aware that Diarrhea, Cholera, Intestinal worms diseases can be prevented and controlled by handwashing. 84(29.7%) know diarrhea only as wash related diseases, 43(15.2%) cholera only, 40(14.1) intestinal worms only. Which also echoed during KIIs discussion:

"We were trained on IPC last year, but we don't have the chlorine test kit to confirm if the water is safe." ."When it's busy, we focus on treating patients first. Cleaning can wait."KII held on 15/5/2026

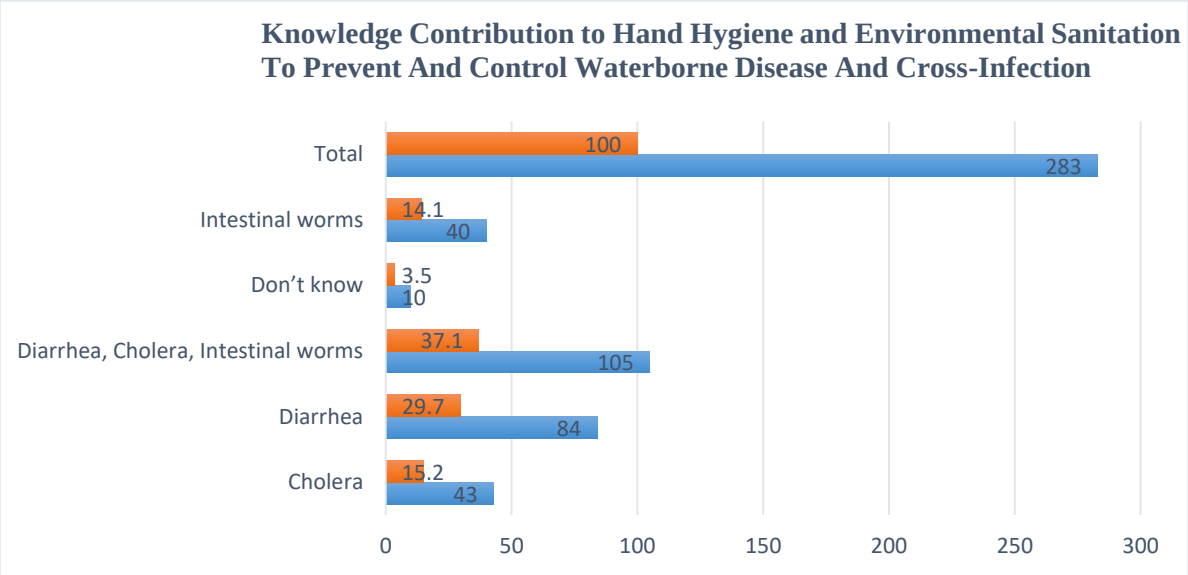


Figure 4.2: Distribution of Knowledge on Hand Hygiene and Environmental Sanitation to Prevent and Control Waterborne Disease and Cross-Infection

Regarding attitudes towards the utilization of hand hygiene and environmental sanitation, most participants, 137(48.4%) agreed that handwashing with soap is important at health centres, with strongly agreeing and 43(15.2%) agreeing, totalling 180(63.6%), while 53(18.8%) disagreed or strongly disagreed and 50(17.7%) were neutral.

Views on toilet safety were more mixed and least positive, with 76(26.9%) strongly agreeing and 47(16.6%) agreeing that it's safe, totalling 123(43.5%), while 89(31.4%) disagreed or strongly disagreed and 71(25.1%) were neutral the highest neutral rate across the three items. For personal responsibility for hygiene, 121(42.8%) strongly agreed and 38(13.4%) agreed they are responsible, totalling 159(56.2%), while 72(25.4%) disagreed or strongly disagreed and 52(18.4%) were neutral. Overall, respondents felt strongest about the importance of handwashing, moderately about personal responsibility, and weakest about toilet safety was rated on the Likert scale below: [1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree]

Table 4.2 Attitudes towards the Utilization of Hand Hygiene and Environmental Sanitation

Variables	Frequency (n)	Percentage (%)
Attitude towards handwashing with soap at health centers		
Strongly Disagree	22	7.8

Disagree	31	11.0
Neutral	50	17.7
Agree	43	15.2
Strongly Agree	137	48.4
Attitude on the Safety Utilization of the toilets at health center		
Strongly Disagree	30	10.6
Disagree	59	20.8
Neutral	71	25.1
Agree	47	16.6
Strongly Agree	76	26.9
My Own Personnel Hygiene when At The Health Center		
Strongly Disagree	32	11.3
Disagree	40	14.1
Neutral	52	18.4
Agree	38	13.4
Strongly Agree	121	42.8

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