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ASSESSING THE IMPACT OF WATER SUPPLY AND SANITATION SERVICES ON COMMUNITY DEVELOPMENT IN PUJEHUN DISTRICT, SOUTHERN SIERRA LEONE

Abu-Bakarr Steven Kamara

School of Public Health, College of Medical Health Sciences Njala University, Sierra Leone.

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*Corresponding author: Abu-Bakarr Steven Kamara

Abstract

Access to safe water supply and adequate sanitation services is essential for sustainable community development, improved public health, and enhanced livelihoods. Despite investments in the Water, Sanitation, and Hygiene (WASH) sector, many communities in Pujehun District, Southern Sierra Leone, continue to face challenges in accessing safe drinking water and adequate sanitation facilities. This study assessed the impact of water supply and sanitation services on community development by examining their availability, accessibility, quality, and socio-economic and health implications. A descriptive cross-sectional research design employing a mixed-methods approach was used. Quantitative data were collected through structured household questionnaires, while qualitative data were obtained from key informant interviews and focus group discussions. A sample of 222 respondents was selected using the Yamane sample size determination formula. Quantitative data were analyzed using descriptive statistics, while qualitative data were analyzed thematically. The findings showed that although access to water and sanitation services has improved in some communities, significant disparities remain. Respondents identified unreliable water supply, inadequate sanitation facilities, poor waste disposal, and recurrent outbreaks of waterborne diseases, including diarrhoea, typhoid, and cholera, as major challenges. Improved WASH services were found to enhance public health, increase school attendance, improve productivity, and reduce healthcare costs. The study concludes that strengthening WASH infrastructure, promoting community participation, improving institutional coordination, and increasing investment in water and sanitation services are essential for achieving sustainable community development and improving the quality of life in Pujehun District, Sierra Leone.

Keywords: Hygiene, Sanitation, Pujehun District, Sierra Leone, Water supply.

INTRODUCTION

Access to safe drinking water, adequate sanitation, and appropriate hygiene practices constitute one of the most important determinants of human health and socioeconomic development (WHO, 2019). Collectively referred to as Water, Sanitation and Hygiene (WASH), these services underpin disease prevention, food security, educational attainment, environmental sustainability, gender equality, and economic productivity (Fejfar et al., 2024). Consequently, universal access to safe water and sanitation has been recognized as a fundamental human right and forms the basis of Sustainable Development Goal (SDG) 6, which seeks to ensure the availability and sustainable management of water and sanitation for all by 2030 (United Nations, 2015). The global importance of this issue cannot be understated; lack of access can hinder socioeconomic development, exacerbate inequalities, and compromise health (WHO, 2023).

Despite global progress in WASH coverage, substantial gaps remain as it is essential not only for health, but for many areas of everyday life (Mcknight, 2014). According to the World Health Organization (WHO)/UNICEF Joint Monitoring Programme, 2.1 billion people lacked safely managed drinking-water services and 3.4 billion lacked safely managed sanitation services in 2024, highlighting the persistent global challenge of achieving universal access to safe water and sanitation (UNICEF, 2025). Globally, WHO (2019) emphasizes that nearly 2 billion people drink contaminated water, leading to hundreds of thousands of deaths annually due to diarrheal diseases (WHO, 2019). Many households that lack safely managed services continue to rely on less secure sources, including unprotected wells and springs and untreated surface water from rivers, lakes, ponds and streams. In 2022, WHO estimated that at least 1.7 billion people globally used a drinking-water source contaminated with faeces, with microbial contamination representing the greatest risk to drinking-water safety (WHO, 2023). Additionally, in India, over 600 million people face high to extreme water stress, affecting health, education, and economic activities (CHAKRABORTI et al., 2019). The burden is disproportionately concentrated in low- and middle-income countries, particularly those in Sub-Saharan Africa, where rapid population growth, inadequate infrastructure, weak institutional capacity, climate variability, and persistent poverty continue to undermine progress toward universal WASH coverage (Apatinga, 2024; Graham et al., 2016; McClelland et al., 2022; Null et al., 2018).

Poor WASH services remain among the leading environmental risk factors contributing to preventable morbidity and mortality worldwide (WHO, 2017b). Unsafe drinking water, inadequate sanitation, and poor hygiene facilitate the transmission of numerous infectious diseases, including diarrhoea, cholera, typhoid fever, dysentery, hepatitis A and E, and several neglected tropical diseases (Bah et al., 2022; Sesay et al., 2022). The WHO estimates that hundreds of thousands of diarrhoeal deaths annually are attributable to unsafe water, sanitation, and hygiene, with children under five years of age carrying the greatest burden (McClelland et al., 2022). Beyond infectious diseases, inadequate WASH services contribute to childhood malnutrition, impaired cognitive development, reduced educational attainment, adverse maternal health outcomes, and diminished economic productivity (Husein et al., 2023).

In Sub-Saharan Africa, the challenges associated with WASH are particularly severe as only 24% of the population has access to safe drinking water, contributing to high rates of waterborne diseases (Unicef Sierra Leone, 2023a). Although access to improved water sources has increased in many countries, safely managed water services remain limited, especially in rural communities where infrastructure is often poorly maintained or entirely absent (United Nations, 2015; WHO, 2023).

Sierra Leone continues to face substantial challenges in achieving universal access to WASH services, despite ongoing government and development-partner investments in the sector. Recent national evidence demonstrates persistent inequalities in WASH access, particularly between urban and rural populations (Bah et al., 2022; World Bank Group, 2025). UNICEF Sierra Leone reports that access to basic drinking water in rural areas increased from 38.2% in 2010 to 54% in 2022, compared with an increase from 72.9% to nearly 80% in urban areas, illustrating the continuing rural-urban disparity (Unicef Sierra Leone, 2026). More recent sector assessments continue to identify inadequate infrastructure, weak institutional capacity, insufficient financing, inefficient service delivery and climate-related pressures as major constraints to WASH improvement in Sierra Leone (Kamara et al., 2022; Sesay et al., 2022). The World Bank's 2025 assessment reported that only 63% of the population had access to basic water services, while sanitation and hygiene coverage remained substantially lower (World Bank Group, 2025).

These deficiencies have important public health consequences. In Sierra Leone, inadequate WASH services have been associated with diarrhoeal diseases, acute respiratory infections, undernutrition and worm infestations, while poor WASH conditions can also increase the risk of infections in healthcare settings and contribute to child morbidity and mortality (Bah et al., 2022). More broadly, the WHO identifies inadequate safe WASH as major drivers of diarrhoeal disease, while limited WASH infrastructure and poor hygiene are important risk factors for cholera transmission. Sierra Leone has also experienced cholera outbreaks requiring large-scale public-health responses, including emergency vaccination and intensified WASH measures (Unicef Sierra Leone, 2023b; WHO, 2017a).

The importance of WASH extends beyond disease prevention to education, livelihoods, gender equality and broader community development. Access to reliable water reduces the time and physical burden associated with water collection, a responsibility that disproportionately falls on women and girls in households without water on the premises (Apatinga, 2024; Kyei-Gyamfi et al., 2026). Evidence from Sub-Saharan Africa shows that women and girls are the primary water collectors in many households without direct access to water, with water collection consuming time that could otherwise be devoted to education, employment and other productive activities (Saputro Wijayanto et al., 2026; Unicef West and Central Africa, 2023). In Sierra Leone, UNICEF reports that inadequate WASH services can contribute to school absenteeism among children through illness and the time required to collect water, with additional consequences for girls related to sanitation and menstrual hygiene (Hans J Overgaard et al., 2021; Unicef Sierra Leone, 2023b).

The relevance of WASH to community development is particularly important in coastal and rural communities such as Sulima. Sulima is a coastal community in southern Sierra Leone with an economy linked substantially to fishing and other livelihood activities

(Johnson, 2024). The National Tourist Board identifies fishing as an important economic activity in the coastal areas of Southern Province, including Sulima, while the Ministry of Tourism and Cultural Affairs has identified Sulima's extensive coastline and natural resources as having significant tourism-development potential (National Tourist Board Sierra Leone, 2026; Sankoh et al., 2025). More recently, UNICEF has specifically highlighted the vulnerability of coastal and fishing communities in Sierra Leone to flooding, saltwater intrusion and poor drainage, which can contaminate water sources and damage sanitation facilities (Unicef Sierra Leone, 2026). These environmental and socioeconomic characteristics make Sulima an important setting for examining WASH conditions at the community level.

Despite the importance of WASH to health and socioeconomic development, community-level evidence from remote coastal settlements such as Sulima remains limited. National and international WASH monitoring systems provide important estimates of service coverage but cannot fully capture household-level perceptions, water-treatment behaviours, sanitation conditions and locally experienced health consequences. Understanding these community-specific realities is therefore essential for designing contextually appropriate WASH interventions. Against this background, this study assessed water supply and sanitation services in Sulima Community, Pujehun District, Southern Sierra Leone, with particular emphasis on perceived water quality, water cleanliness, sanitation services, household drinking-water treatment practices, and self-reported diseases perceived to be associated with WASH conditions. The findings are intended to provide relevant evidence to inform community-level WASH planning and support government authorities, development partners and other stakeholders in strengthening WASH services and advancing progress towards Sustainable Development Goal 6.

MATERIALS AND METODS

Study Design

This study employed a community-based cross-sectional quantitative research design to assess the impact of water supply and sanitation services on community development in Sulima Community, Pujehun District, Southern Sierra Leone. The cross-sectional design enabled the collection of quantitative data from households at a single point in time, providing a snapshot of the prevailing conditions of water supply, sanitation services, hygiene practices, and their perceived effects on health and community development. The quantitative approach was appropriate because it facilitated the systematic collection and analysis of numerical data on key WASH indicators, including water quality, sanitation services, household water treatment practices, and WASH-related health outcomes. The findings provide evidence to inform policies and interventions aimed at improving water, sanitation, and hygiene services in rural communities.

Study Area

Sulima Community is strategically located at the confluence of the Moa River and the Atlantic Ocean in Soro Gbema Chiefdom, Pujehun District, Southern Sierra Leone. The community is characterized by an extensive coastline, mangrove ecosystems, estuarine environments, and proximity to the Liberian border. Its economy is predominantly based on artisanal fishing, subsistence agriculture, petty trading, and cross-border commerce. Despite its

strategic location and considerable tourism and maritime development potential, Sulima remains one of the relatively underserved coastal communities in Sierra Leone with persistent challenges related to safe water supply, sanitation infrastructure, and environmental management. Seasonal flooding, saline intrusion into groundwater, inadequate waste disposal systems, and limited WASH infrastructure present significant public health concerns, making the community an appropriate setting for assessing the impact of water supply and sanitation services on community development.

Study Population

The study population comprised all households in Sulima Community, Pujehun District, Southern Sierra Leone. The unit of analysis was the household, and the unit of observation was the household head or, in their absence, the spouse (husband or wife) if they are knowledgeable about the household's WASH practices.

The study population comprised all 384 households identified in Sulima Community, Pujehun District, Southern Sierra Leone. A census approach was adopted, whereby all eligible households were approached for participation. One eligible adult respondent, preferably the household head or spouse, was invited from each household.

Inclusion Criteria

Households were included in the study if they met the following criteria:

1. The household was located within Sulima Community during the study period.
2. The household had a resident household head or spouse (husband or wife) aged 18 years or older.
3. The respondent had resided in the household for at least one year prior to the study to ensure adequate knowledge of the household's water supply, sanitation, and hygiene practices.
4. The respondent was willing to participate in the study and provided informed consent.

Exclusion Criteria

The following were excluded from the study:

1. Households that were vacant or unoccupied during the data collection period.
2. Visitors and temporary residents who were not permanent members of the household.
3. Individuals younger than 18 years.
4. Eligible respondents who declined to participate or were unable to provide informed consent due to severe illness or communication difficulties.

Sample Size & Technique

A census approach was adopted for this study. Rather than selecting a sample of households, all eligible households within Sulima Community were included to ensure comprehensive coverage of the study area. In each household, the household head was invited to participate in the survey. Data was collected by the researcher and two researcher assistants and only participants that met the inclusion criteria were involved. Upon household mapping

of the Sulima town, 384 households were mapped representing the sample size.

The use of a census approach eliminated sampling error associated with probability sampling techniques and ensured that the findings reflected the experiences and perceptions of the entire study population within Sulima Community (Singh & Masuku, 2014). The use of a census approach ensured complete coverage of the target population, minimized sampling bias, and enhanced the representativeness of the findings.

Of the 384 eligible households approached, 222 respondents voluntarily provided informed consent and completed the questionnaire, giving a response rate of approximately 57.8%. The remaining 162 eligible respondents declined participation and were therefore excluded from data collection and analysis in accordance with the principle of voluntary participation. Consequently, the final analytical sample consisted of 222 respondents.

Development of the Data Collection Instrument

Data were collected using a structured questionnaire developed in accordance with the objectives of the study and grounded in relevant literature on WASH. The questionnaire items were adapted from established WASH concepts and indicators and subsequently contextualized to reflect the environmental and socio-economic conditions of Sulima Community. In particular, the development of questions relating to sources of drinking water, accessibility, availability, water quality, sanitation and household hygiene practices was informed by the WHO/UNICEF Joint Monitoring Programme recommendations for household WASH surveys (United Nations Children's Fund (UNICEF) & WHO, 2018). These indicators provide a standardized framework for assessing household access to and utilization of water, sanitation and hygiene services.

Questions relating to the perceived quality and cleanliness of drinking water, household water treatment and water-related health risks were further informed by the WHO Guidelines for Drinking-water Quality, which emphasize drinking-water safety, risk management and the prevention of water-related diseases (WHO, 2017b). The inclusion of questions on diarrhoea, cholera, typhoid and other perceived WASH-related illnesses was also supported by evidence demonstrating the close relationship between inadequate water, sanitation and hygiene conditions and the burden of infectious diseases (Bartram & Cairncross, 2010; van den Broek & Brown, 2015).

The accessibility and affordability component of the questionnaire examined the frequency of water shortages, distance to water sources, affordability of services and household expenditure on water and sanitation. These variables were included because access to WASH services extends beyond the physical presence of infrastructure to include reliability, proximity and financial accessibility. The economic importance of improved water and sanitation services, including potential reductions in healthcare expenditure and productivity losses, has been widely recognized (Hutton, 2013).

The questionnaire also incorporated items on sustainability, community participation and local involvement in WASH management. Community participation is important for promoting ownership, maintenance and long-term sustainability of rural water and sanitation systems (Rivett et al., 2019; van den Broek & Brown, 2015). Questions were therefore included on participation

in WASH-related decision-making, attendance at community meetings, community-led initiatives, water conservation practices and willingness to participate in future WASH activities.

The final component assessed respondents' awareness and perceptions of NGOs operating within the WASH sector, including their perceived effectiveness and responsiveness to community needs. These items were included to provide information on the contribution of external organizations and community-level interventions to WASH service improvement.

The questionnaire consisted predominantly of closed-ended questions using categorical response options and five-point rating scales to facilitate quantitative analysis. It was organized into demographic characteristics and five substantive sections covering: **(A)** impact of water and sanitation services on the community; **(B)** service accessibility and affordability; **(C)** sustainability of WASH practices; **(D)** community participation; and **(E)** the role of NGOs. An open-ended question was included at the end of the instrument to allow respondents to provide additional observations and recommendations concerning water and sanitation services in Sulima Community.

A consent statement preceded the questionnaire. Participants were informed of the nature and purpose of the study and were required to indicate their voluntary willingness to participate before the questionnaire was administered.

Data Collection Procedure

Data were collected through direct administration of the structured questionnaire to eligible households in Sulima Community by the researcher and two research assistants. Two days training was done for the research assistants to administer the questionnaire properly. Although all 384 households were approached under the census strategy, participation was strictly voluntary. Before questionnaire administration, the purpose and procedures of the study were explained to each eligible respondent, together with their right to decline participation or withdraw without penalty.

Of the 384 eligible households approached, 222 respondents provided informed consent and completed the questionnaire. No questionnaire was administered to individuals who declined consent. Thus, only data from the 222 consenting respondents were included in the final analysis.

Data Analysis Procedure

Following data collection, completed questionnaires were checked for completeness and consistency. Responses were coded and entered into Microsoft Excel 2016, where the dataset was cleaned to identify missing values, data-entry errors and inconsistencies. The cleaned data were subsequently imported into IBM SPSS Statistics for analysis.

Descriptive statistical methods were used to summarize the data in accordance with the study objectives and the categorical nature of the questionnaire responses. Frequencies and percentages were calculated for respondents' demographic characteristics and major WASH indicators, including perceived water quality and cleanliness, sanitation services, water-treatment practices, accessibility and affordability of water services, WASH-related health outcomes, sustainability practices, community participation and perceptions of NGO involvement.

Responses measured using five-point rating scales were summarized using frequency and percentage distributions to

demonstrate the pattern of respondents' perceptions across the different response categories. Where appropriate, findings were presented in tables and charts to facilitate interpretation and comparison.

Responses to the final open-ended question were reviewed and grouped according to recurring issues and suggestions relating to water and sanitation services. The results of the analysis were interpreted in relation to the objectives of the study.

RESULTS

A total of 384 eligible households were approached during the household census. Of these, 222 respondents provided informed consent and completed the questionnaire, representing approximately 57.8% of the eligible population. The remaining 162 households did not consent to participate and were excluded from the analysis. Accordingly, all subsequent results are based on the 222 completed questionnaires.

The findings are presented according to the major WASH indicators assessed in Sulima Community. The results focus on respondents' perceptions of water supply quality and cleanliness, sanitation services, perceived health effects, commonly reported WASH-related diseases and household drinking-water treatment practices.

Water Supply, Cleanliness and Sanitation Services

Table 1. Assessment of Water Supply and Sanitation Services in Sulima Community

Indicator	Response	Frequency	Percentage (%)
Quality of Water Supply	Very Poor	5	2.25
	Poor	62	27.93
	Moderate	148	66.67
	Better	7	3.15
Water Cleanliness	Very Clean	1	0.45
	Very Dirty	1	0.45
	Better	37	16.67
	Dirty	49	22.07
	Moderate	134	60.36
Sanitation Services	Very Poor	3	1.35
	Poor	55	24.77
	Moderate	158	71.17
	Better	6	2.70

Table 1 shows that respondents generally perceived existing water and sanitation services as moderate rather than good. Regarding the overall quality of water supply, 148 respondents (66.67%) rated it as moderate, while 62 (27.93%) considered it poor. Only 7 respondents (3.15%) rated the water supply as better, whereas 5 (2.25%) described it as very poor.

A similar pattern was observed for water cleanliness. The majority, 134 respondents (60.36%), rated the cleanliness of available water

as moderate, while 49 (22.07%) described it as dirty. Thirty-seven respondents (16.67%) considered the water cleanliness better. Only 1 respondent (0.45%) rated the water as very clean and another 1 (0.45%) as very dirty.

Sanitation services were also rated as moderate, accounting for 158 respondents (71.17%). However, 55 respondents (24.77%) rated sanitation services as poor, while only 6 (2.70%) considered them better and 3 (1.35%) rated them as very poor. Overall, these findings indicate that although basic water and sanitation services were available, respondents perceived considerable room for improvement in their quality and adequacy.

Perceived Health Impact of Water and Sanitation Services

Table 2. Perceived Impact of Water and Sanitation Services on Health

Perceived Health Impact	Frequency	Percentage (%)
Highly Positive	2	0.90
Slightly Positive	168	76.02
Neutral	3	1.36
Slightly Negative	48	21.72

The majority of respondents, 168 (76.02%), perceived the effect of existing water and sanitation services on health as slightly positive. In contrast, 48 respondents (21.72%) perceived the impact as slightly negative. Only 2 respondents (0.90%) considered the health impact highly positive, while 3 (1.36%) expressed a neutral view.

The findings therefore suggest that most respondents recognized some health benefits associated with existing WASH services; however, the very small proportion reporting a highly positive impact indicates that the perceived benefits were limited rather than substantial.

Commonly Reported WASH-Related Diseases

Table 3. Common Diseases Reported in Relation to WASH Problems

Disease	Frequency	Percentage (%)
Diarrhoea	20	40.00
Typhoid	10	20.00
Dysentery	8	16.00
Cholera	5	10.00
Skin infections	4	8.00
Other illnesses, including hepatitis	3	6.00
Total	50	100.00

Among the reported WASH-related illnesses, diarrhoea was the most common, accounting for 20 cases (40.00%). Typhoid was the second most frequently reported condition, with 10 cases (20.00%), followed by dysentery with 8 cases (16.00%). Cholera accounted for 5 cases (10.00%), while skin infections represented 4

cases (8.00%). Other reported illnesses, including hepatitis, accounted for 3 cases (6.00%).

The distribution shows that gastrointestinal illnesses constituted the majority of the reported health problems, particularly diarrhoea, typhoid, dysentery and cholera.

Household Drinking-Water Treatment Practices

Table 4. Frequency of Household Drinking-Water Treatment

Water Treatment Practice	Percentage (%)
Rarely	42.60
Never	31.84
Once in a while	23.77
Always	1.35
Non-response/Other	0.45
Total	100.00

Household treatment of drinking water was generally uncommon. The largest proportion of respondents (42.60%) reported that they rarely treated their drinking water, while 31.84% indicated that they never treated it. A further 23.77% treated their water only occasionally. In contrast, just 1.35% reported consistently treating their drinking water.

Taken together, 74.44% of respondents either rarely or never treated their drinking water. This finding demonstrates that routine household-level drinking-water treatment was not widely practised among respondents in Sulima Community.

DISCUSSION

This study assessed household perceptions and practices relating to water supply, sanitation and hygiene in Sulima Community, Pujehun District, Southern Sierra Leone. Overall, the findings reveal a community in which WASH services are present but remain inadequate in quality, reliability and household-level safety practices. Most respondents described water supply, water cleanliness and sanitation services as moderate, while a substantial minority rated these services as poor or dirty. At the same time, WASH-related illnesses were reported, and routine household treatment of drinking water was uncommon. Taking together, these findings suggest that the existence of WASH services in Sulima does not necessarily translate into consistently safe, adequate or optimally utilized services.

Perceived Quality of Water Supply and Water Cleanliness

Approximately two-thirds of respondents rated the overall quality of water supply as moderate, while a significance amount rated it as poor. Similarly, more than half perceived water cleanliness as moderate and about 1/4th considered the water dirty. This pattern is important because it suggests that respondents generally did not perceive their water situation as completely unacceptable, but neither did they consider it highly satisfactory. The concentration of responses within the “moderate” category may therefore represent a situation of partial access in which water is available but concerns remain regarding cleanliness, reliability or suitability for consumption.

This finding is consistent with the broader WASH situation in Sierra Leone. The 2022 WASH National Outcome Routine

Mapping report indicated that only 62.6% of the population had access to basic water services, while only 9.4% had an improved protected water source within their premises. It further reported that 70.3% of households experienced water unavailability for at least one complete day during the preceding two weeks (Unicef Sierra Leone, 2023a). The Sulima findings therefore fit within a national context in which physical access to water has improved, but reliability, proximity and service quality remain substantial concerns.

A particular caution is required in interpreting respondents' perceptions of water cleanliness. A water source that appears clean or is perceived as moderately clean may still be microbiologically unsafe. The present study assessed perceived cleanliness rather than undertaking microbiological or physicochemical testing. Consequently, the findings should not be interpreted as evidence that the water met drinking-water quality standards.

This distinction is especially important in Sierra Leone. The 2017 Multiple Indicator Cluster Survey reported *E. coli* contamination in 89.6% of tested source-water samples and 97.0% of household drinking-water samples, while only 1.5% of household members met the criteria for safely managed drinking water under the indicators used in that survey (Statistics Sierra Leone, 2018). Similarly, Kamara et al. (2022), who tested wells and standpipes in two Freetown communities, detected *E. coli* in all water sources sampled; all five wells and 25% of standpipes had at least an intermediate *E. coli* risk level (Kamara et al., 2022).

These findings help contextualize the Sulima result. The fact that more than half of respondents considered their drinking water moderately clean cannot be equated with microbiological safety. Indeed, national and local Sierra Leonean evidence demonstrates that visually acceptable or improved water sources may still be contaminated (Sesay et al., 2022; Xavier Chauvot De Beauchene et al., 2025). This has important implications for WASH programming in Sulima: improvements should not focus solely on increasing the number of water points but should incorporate routine water-quality surveillance, protection of sources, maintenance of infrastructure, safe transportation and storage, and household-level risk reduction.

The geographical characteristics of Sulima may intensify these concerns. The community is coastal and located close to the Moa River and Atlantic Ocean, with reported exposure to seasonal flooding, saline intrusion, inadequate waste disposal and limited WASH infrastructure. Such conditions can increase opportunities for contamination of shallow groundwater and surface-water sources, especially where sanitation facilities and waste-management systems are inadequate. The implications are therefore not merely infrastructural but environmental: water security in Sulima requires attention to source protection, flooding, drainage, waste disposal and climate resilience.

Comparable challenges have been documented elsewhere in sub-Saharan Africa. Yang et al. (2025), using population-based data from rural communities in Ghana, Malawi, Mozambique, Niger, Rwanda, Uganda and Zambia, demonstrated substantial microbial contamination of household drinking water and found that factors such as improved water sources, continuous supply, improved sanitation, safe water storage and hygiene conditions were associated with lower contamination in particular countries (Yang et al., 2025). Similarly, a multi-country analysis of rural households across nine SSA countries found *E. coli* in 71% of

household drinking-water samples, illustrating that microbial water contamination remains a widespread rural challenge even where households may consider their water acceptable (Yang et al., 2025).

Thus, the Sulima finding is not an isolated phenomenon. It reflects a broader SSA problem in which access, continuity, water quality and safe household management must be considered together. Infrastructure alone is therefore an incomplete measure of water security.

Assessment of Sanitation Services

Sanitation services showed a similar pattern. Most respondents rated sanitation services as moderate, while almost one-quarter rated them as poor. Only 2.70% considered the services better. This suggests that respondents recognized the existence of some sanitation arrangements but did not consider them adequate or of high quality.

The result is broadly compatible with national evidence showing that sanitation remains one of Sierra Leone's most significant WASH challenges. WASHNORM 2022 estimated access to basic sanitation at only 13.6%, while 47.8% of households shared toilet facilities and approximately 25.1% of Sierra Leoneans practised open defecation. Particularly relevant to the present study, open defecation was reported to be highest in the Southern Region, at 43.5%, and rural populations were considerably more likely than urban populations to practise open defecation.

However, the apparently more favourable perception in Sulima should not be directly compared numerically with these national indicators. The present study asked respondents to rate sanitation services on a perception scale, whereas WASHNORM classified facilities according to standardized service-level criteria. A respondent may therefore perceive a traditional or shared latrine as “moderate” even though it does not fulfil the technical definition of a basic or safely managed sanitation service. This difference between perceived adequacy and objective service standards is an important interpretation of the findings.

A Sierra Leonean study similarly found major sanitation deficiencies in a survey of 1,002 households across four districts in Sierra Leone: only 17% had improved sanitation and just 5% had a handwashing facility. Rural households were particularly disadvantaged (Sesay et al., 2022). These observations reinforce the view that sanitation inadequacy in Sulima forms part of a broader structural rural WASH problem rather than merely a household preference issue.

The implications extend beyond sanitation infrastructure itself. Where excreta are inadequately contained, faecal organisms can enter the domestic environment through soil, surface runoff, groundwater, hands, food, flies and household water. In a coastal environment experiencing flooding, these pathways may become especially important (Husein et al., 2023). Improving sanitation in Sulima should therefore be approached as part of an integrated environmental-health strategy rather than simply through construction of additional latrines.

Evidence across SSA supports this integrated approach. A multinational survey analysing data from 33 sub-Saharan African countries, demonstrated that water and sanitation conditions remain important components of the broader epidemiology of childhood diarrhoea, although disease patterns varied considerably between countries and communities (Amadu et al., 2023). Ghanaian

evidence similarly shows persistent rural and socioeconomic inequalities in both improved water and sanitation despite substantial national progress (Husein et al., 2023). Thus, Sulima illustrates the same regional challenge: expanding infrastructure must be accompanied by equitable access, functionality, maintenance, behavioural adoption and environmental protection.

Perceived Health Impact of WASH Services

A particularly interesting finding was that more than half of respondents considered the health impact of existing water and sanitation services to be slightly positive, whereas 21.72% perceived a slightly negative effect. Only 0.90% described the impact as highly positive.

At first sight, this may appear inconsistent with the reported deficiencies in water quality, sanitation and WASH-related diseases. However, the two findings can coexist. A community may experience some health improvement after gaining access to water points or sanitation facilities while remaining exposed to considerable risks. The dominance of the category “slightly positive,” rather than “highly positive,” arguably reflects this intermediate situation. Existing WASH services may be providing some benefit compared with having no services at all, but their quality, coverage, functionality or utilization may be insufficient to generate substantial perceived health improvements.

This interpretation is supported by experience elsewhere in Sierra Leone. A Sierra Leonean study evaluated a water-vending kiosk intervention in low-income communities in Freetown and found only a 0.6% improvement in household microbial water quality and an 8.2% improvement in reported water security (Falcone et al., 2023). Low functionality and adoption limited the impact of the intervention. The comparison is instructive: installing or introducing WASH infrastructure does not automatically generate large health or water-security benefits if systems are unreliable, inadequately maintained or poorly adopted.

Evidence from other SSA settings likewise demonstrates that the relationship between WASH infrastructure and health is not always straightforward. In rural Tanzania, improved water sources were associated with lower odds of childhood diarrhoea in household-level analyses, supporting the potential health benefits of safer water access (McClelland et al., 2022). However, major randomized trials in Kenya and Zimbabwe have found that relatively basic household water, sanitation and handwashing interventions did not consistently reduce childhood diarrhoea or enteric infection. A subsequent expert consensus interpretation of these trials concluded that conventional low-intensity WASH interventions may be insufficient in environments where faecal contamination is widespread and multiple exposure pathways remain.

This contrast is highly relevant to Sulima. It suggests that the goal should not simply be “more WASH facilities,” but rather transformative and consistently functioning WASH services capable of interrupting multiple transmission pathways. Reliable safe water, adequate sanitation, handwashing with soap, proper waste disposal, drainage, safe child faeces management and household water safety must operate together.

WASH-Related Illnesses

Among the 50 WASH-related illnesses represented in the disease table, diarrhoea constituted the largest proportion followed by typhoid, dysentery, cholera, skin infections and other illnesses,

including hepatitis. The predominance of gastrointestinal illnesses is epidemiologically plausible in a setting characterized by concerns about water cleanliness, sanitation and limited household water treatment.

The current study findings were carefully interpreted as the percentages were not interpreted as prevalence estimates among the surveyed group. In addition, these conditions were self-reported rather than clinically or laboratory confirmed. Consequently, the study demonstrates perceived or reported WASH-related morbidity but cannot establish that contaminated water or inadequate sanitation caused individual episodes of diarrhoea, typhoid, cholera or dysentery.

Despite these limitations, the prominence of diarrhoea is consistent with previous Sierra Leonean evidence which reported diarrhoeal illness in 17% of households surveyed within the preceding two weeks (Sesay et al., 2022). In another Sierra Leonean context analysing the same focus, estimated diarrhoeal disease prevalence at 12.3% and found that use of unimproved water sources was independently associated with higher odds of diarrhoeal disease (Bah et al., 2022).

The Sulima data cannot be directly compared numerically with these prevalence estimates because the denominators and recall measures differ. Nevertheless, the *pattern* is comparable: diarrhoeal disease continues to appear as an important manifestation of inadequate WASH conditions in Sierra Leone.

The wider SSA literature provides further support. A SSA study that used Demographic and Health Survey data from 33 SSA countries, reported childhood diarrhoea among approximately 16% of children represented in the pooled analysis, although prevalence varied considerably across countries and subregions (Amadu et al., 2023). Studies in Tanzania have also linked improved water access and improved waste-management practices with lower diarrhoeal risk (McClelland et al., 2022), while studies in coastal Ghana have reported high diarrhoeal burdens even where improved water sources were widely used (Yang et al., 2025).

The latter comparison is particularly relevant to Sulima because it demonstrates that classification of a water source as “improved” does not necessarily guarantee safe water at the point of consumption. Contamination can occur at the source, during collection, during transport, in storage containers or through unsafe handling within the household. Ghanaian household water-quality research has demonstrated that storage itself can be associated with higher *E. coli* contamination, particularly in rural settings. Therefore, controlling diarrhoeal disease in Sulima requires interventions across the full water chain, from source to point of consumption.

The presence of self-reported typhoid, dysentery and cholera further indicates community concern about enteric disease. These findings should motivate stronger surveillance and prompt investigation during suspected outbreaks, rather than being interpreted as diagnostic evidence. Strengthening community case recognition, early referral, water-quality monitoring and outbreak preparedness would be especially important in a coastal settlement vulnerable to flooding and contamination.

Household Drinking-Water Treatment

One of the most concerning findings was the low level of routine household water treatment. Approximately 42.60% of respondents rarely treated their drinking water and 31.84% never treated it,

meaning that 74.44% either rarely or never undertook household water treatment. A further 23.77% treated water only occasionally, while just 1.35% reported always treating drinking water.

This finding closely mirrors national patterns. WASHNORM 2022 found that approximately 67% of Sierra Leonean households did not treat drinking water to make it safer (Unicef Sierra Leone, 2023a). Likewise, another study concluded that point-of-use water-treatment practices among Sierra Leonean households were poor (Sesay et al., 2022). Earlier qualitative work in rural Sierra Leone also documented very low adoption of preventive household water-treatment behaviours, illustrating that this challenge has persisted over time (McMahon et al., 2013).

The Sulima result may therefore reflect both infrastructural and behavioural vulnerabilities. If water is potentially contaminated but household treatment is rarely practised, exposure may continue even where access to a nominally improved source exists. This again emphasizes that increasing water access without promoting safe handling and effective treatment may leave a substantial portion of health risk unchanged.

There is evidence from SSA that effective household water treatment can substantially improve microbiological water quality under appropriate conditions. A randomized trial in rural Ghana found that household BioSand filtration substantially reduced *E. coli* concentrations and was associated with lower diarrhoeal disease occurrence (Oppong et al., 2022). A trial in western Kenya similarly demonstrated reductions in childhood diarrhoea with household treatment using a flocculant-disinfectant in settings with turbid source water (Null et al., 2018).

However, not all studies have demonstrated equivalent health benefits. Other trials in Ghana and the large WASH Benefits trial in rural Kenya found limited or no significant reduction in diarrhoea from some household treatment interventions, particularly where adherence declined or multiple environmental exposure pathways remained. Therefore, the implication for Sulima is not simply that households should be told to treat water. Sustainable household water safety requires affordable treatment products, culturally acceptable methods, consistent availability, user knowledge, correct treatment procedures, safe storage and sustained behaviour change.

Implications for Community Development

The findings have implications beyond the immediate occurrence of disease. Inadequate WASH can affect household expenditure, productivity, education, gender equity and the overall capacity of a community to develop. Repeated illness can reduce working days and increase household expenditure on treatment. Unreliable water services may also require households to devote substantial time to water collection rather than livelihood, educational or community activities.

These concerns are especially important in the SSA context, where much of the burden of collecting water falls on women and children. Analysis across 24 SSA countries found that adult women were the predominant water collectors in households requiring long collection times and that female children carried a disproportionate share of child water-collection responsibilities (Graham et al., 2016). Sierra Leone was among the countries exhibiting important gender differences in water-collection labour. More recent multi-country evidence similarly shows that lack of on-premises water continues to impose substantial time burdens across SSA,

particularly in rural settings (Fejfar et al., 2024; Graham et al., 2016).

Although the present Sulima results do not quantify these effects and should therefore not be used to claim local school absenteeism or productivity loss directly, the findings indicate conditions through which such effects could arise. Nationally, the economic significance of WASH is increasingly recognized: the World Bank has estimated substantial productivity and health-related economic losses from inadequate WASH in Sierra Leone and has placed water security and sanitation at the centre of the country's 2025-2035 WASH development programme (Xavier Chauvot De Beauchene et al., 2025).

From a development perspective, improving WASH in Sulima should therefore be considered an investment in human capital and community resilience rather than merely a health-sector intervention. Reliable water and sanitation may reduce preventable illness, protect household resources, support livelihood activities, improve dignity and create conditions more favourable to education and local economic participation.

Overall Interpretation and Policy Implications

Taken together, the findings portray an important paradox. Most residents did not describe WASH conditions as extremely poor; instead, they commonly rated services as moderate and perceived their health contribution as slightly positive. Yet substantial proportions reported concerns about dirty or poor water and sanitation, WASH-related diseases remained evident, and routine household water treatment was extremely limited. This suggests that Sulima may have achieved partial WASH access without achieving comprehensive WASH safety.

This distinction is important for policy. The next stage of WASH development in Sulima should move beyond counting facilities toward evaluating whether services are safe, functional, accessible, reliable, affordable and sustainably managed. This is consistent with Sierra Leone's WASHNORM framework, which emphasizes functionality, water quality, affordability, user participation, reliability, sustainability and service levels rather than infrastructure alone.

The findings therefore support an integrated strategy involving protection and routine testing of drinking-water sources; rehabilitation and maintenance of existing water points; improvement of sanitation and faecal-waste containment; strengthened drainage and waste management, particularly because of Sulima's coastal and flood-prone environment; promotion of feasible household water-treatment and safe-storage practices; hygiene education; and stronger community participation in the management and maintenance of WASH facilities.

Community ownership will be particularly important. Infrastructure that is introduced without arrangements for financing, maintenance, accountability and local management may deteriorate or remain underused. Evidence from Freetown's water-kiosk intervention illustrates how low functionality and adoption can substantially limit the benefits of technically appropriate WASH investments. Thus, sustainable improvement in Sulima will require coordination among households, community leadership, local government, the Ministry responsible for water and sanitation, health authorities, NGOs and other development partners.

Finally, the study findings should be interpreted within their methodological limits. Because the study was cross-sectional and primarily descriptive, causal relationships between WASH conditions and reported illness cannot be established. Water quality was based largely on respondents' perceptions rather than laboratory measurements, and disease reports were not clinically verified. Furthermore, 222 of the 384 eligible households consented to participate, giving a response rate of approximately 57.8%; the possibility of non-response bias cannot therefore be completely excluded. Future research in Sulima would be strengthened by microbiological testing of water at the source and household point of use, direct observation of sanitation and hygiene conditions, seasonal assessment during dry and rainy periods, and analytical examination of relationships between specific WASH exposures and health outcomes.

Despite these limitations, the findings provide locally relevant evidence of important gaps in water quality, sanitation and household water-safety behaviour. Their consistency with national Sierra Leonean evidence and wider SSA research strengthens the conclusion that sustainable community development in Sulima will require not simply greater WASH coverage, but safer, more reliable, better maintained and behaviourally supported WASH services.

Conclusion

The study concludes that, despite some improvements, significant challenges remain in providing adequate WASH services in Sulima Village. Water quality and sanitation services are insufficient for a substantial part of the community, contributing to health issues and a lower quality of life. Limited community involvement and the perceived ineffectiveness of NGOs further exacerbate these challenges.

Authors' Contributions

I did conceptualization, design, methodology, data collection, data analysis, interpretation of findings, and preparation of the manuscript. The author also reviewed and approved the final version of the manuscript for submission.

Ethical Approval

Ethical Considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki, including respect for autonomy, voluntary participation, informed consent, confidentiality and protection of research participants. Ethical approval was obtained from the Njala University Institutional review and ethics board before data collection.

Confidentiality and privacy were maintained throughout data collection, analysis and reporting. Personal identifiers were not required for participation, and findings were reported in aggregate form to prevent identification of individual respondents. Community engagement was promoted by sharing the study findings and addressing participants' questions and concerns.

Disclosure of Conflict of Interest

I declare no conflict of interest.

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