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Evaluation of Water Supply, Sanitation and Hygiene Intervention in Schools, Health Care Facilities and Communities for the Prevention of Diarrhoea Diseases in Lindi Region, Tanzania

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Abstract

Introduction

Water, sanitation, and hygiene (WASH) are vital for preventing diarrhoea. A 2019 baseline study in Mtama District Council and Lindi Municipal Council reported a 13% prevalence of diarrhoea among children under five. Only 3 of 12 primary schools had a reliable water supply, while none of the six health facilities did. School children and caregivers had low hygiene knowledge and practices. A three-year project was implemented to improve WASH services and raise hygiene knowledge and practices to reduce diarrhoea among children under five. This evaluation assessed improvements in WASH conditions in targeted schools, health facilities and communities, examined changes in diarrhoea prevalence, and explored the sustainability of implemented interventions.

Methods

The evaluation employed both quantitative and qualitative methods. Interviews with government officials, community members, and school children were conducted. An observation checklist was used to assess constructed or renovated water supply, sanitation, and hygiene infrastructure in schools and health facilities. The Organisation for Economic Co-operation and Development (OECD/DAC) criteria were used to evaluate relevance, effectiveness, efficiency, coherence, sustainability, and coordination.

Results

The prevalence of diarrhoea among children under five years of age decreased from 13% to 9.6%. Water supply infrastructure in all project schools and healthcare facilities was either renovated or newly constructed. Nearly all school children (99%) received training in handwashing practices; 98% demonstrated adequate knowledge of critical handwashing moments, and 91% accurately identified the proper handwashing steps. Among caregivers, 90% had adequate knowledge of proper handwashing. The project met all OECD/DAC evaluation criteria.

Conclusion

The WASH project achieved its objectives by improving infrastructure and services and by training schoolchildren and caregivers, thereby contributing to a reduction in diarrhoea prevalence. Basic drinking water coverage in targeted schools and health facilities increased, with a reliable year-round supply. The project met all OECD/DAC evaluation criteria, demonstrating relevance, effectiveness, efficiency, coherence, coordination, and sustainability. The evaluation recommends that Mtama District Council and Lindi Municipal Council sustain these achievements through continued collaboration, stakeholder engagement, and shared responsibility to maintain improved WASH outcomes and ensure long-term impact in the Lindi region.

Keywords: *Diarrhoea, Waterborne Diseases, OECD/DAC, Evaluation Criteria, Tanzania, WASH*

INTRODUCTION

The World Health Organization (WHO) defines waterborne diseases as those that are transmitted by the ingestion of contaminated water (WHO, 2022). Important waterborne diseases include diarrheal diseases, cholera, shigella, typhoid, hepatitis A and E, and poliomyelitis (Manetu & Karanja, 2021). Diarrheal diseases are the third leading cause of child mortality globally. In Tanzania, according to the Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS, 2022), diarrheal diseases were among the top five causes of childhood illness among children under five years, with a prevalence of 9 % (TDHS, 2022). The main contributing factors include unsafe water supply, inadequate sanitation, and lack of hygiene (Girma et al., 2024; Pickering et al., 2019).

A WASH project was launched in two districts, namely Mtama District Council (DC) and Lindi Municipal Council (MC), Lindi region, in 2019. Before the project implementation, a baseline survey was conducted, and it revealed that out of 12 primary schools that were the target of the intervention, only 3 had a drinking water source. None of the six targeted health care facilities had access to a continuous, sufficient, clean, and safe water supply (a reliable water source). The prevalence of diarrhoea in children under five years was 13%.

The project aimed to reduce the prevalence of waterborne diseases by improving access to safe water, sanitation, and hygiene (WASH) in schools and healthcare facilities. The intervention focused on three key components: implementing a School-Led Total Sanitation (SLTS) campaign, a hygiene education campaign for caregivers, and strengthening the capacity of local leaders in WASH governance. Each component was designed to address a specific area contributing to poor WASH outcomes in the community.

Under the SLTS component, the project aimed to eliminate open defecation in schools and promote safe sanitation and hygiene behaviours among students and surrounding communities. To achieve this, participatory sanitation mapping and triggering sessions were conducted in schools to raise awareness among students, teachers, and parents. Schools developed their sanitation action plans, and support was provided for the construction or rehabilitation of gender-sensitive latrines and handwashing stations. Additionally, student-led health and hygiene clubs were formed to encourage peer-to-peer hygiene promotion and sustain behavioural change.

The hygiene education campaign for caregivers targeted households, particularly caregivers of children under five, to improve hygiene practices and reduce the incidence of diarrheal diseases. The project organised community dialogue sessions and home visits to promote key hygiene behaviours, such as handwashing with soap, safe water storage, and proper waste disposal. Demonstrations and distribution of Information, Education, and Communication (IEC) materials were also conducted to reinforce these messages and support long-term adoption of healthy hygiene practices at the household level.

To ensure sustainability, the project also focused on strengthening the capacity of local leaders on WASH governance. Training sessions were held for local government officials, village leaders, school management committees, and health workers on topics such as WASH planning and budgeting, coordination mechanisms, monitoring and evaluation, and community engagement strategies. The project supported the establishment or revitalization of WASH committees at the community level to improve accountability and coordination of WASH services and interventions. The evaluation was conducted three years after project implementation to determine whether the WASH interventions achieved the expected outcomes.

METHODS

Evaluation design and context

This evaluation was conducted in the Lindi MC and Mtama DC, located in the Lindi Region. I t employed a mixed-methods study design, integrating both quantitative and qualitative approaches to provide a comprehensive understanding of the implementation and outcomes of WASH interventions in selected schools and healthcare facilities. The mixed-methods approach was purposively selected because it enhances the validity of the findings and enables a more nuanced interpretation of the results. A quantitative approach employed a cross-sectional study design to assess the status of water, sanitation, and hygiene in targeted schools and healthcare facilities. Moreover, it enabled the measurement of various aspects, such as functionality, accessibility, and beneficiaries' satisfaction.

The cross-sectional approach was chosen for its efficiency in collecting data from a large sample within a limited timeframe and for its suitability for generating descriptive statistics that can inform policy and practice. A qualitative approach was employed to explore the lived experiences and perceptions of stakeholders involved in or impacted by the WASH interventions in the two districts. Focus group discussions with caregivers and in-depth interviews were conducted with government officials and primary healthcare facility staff to gain insight into the impact of WASH interventions, as well as the challenges and contextual factors that influence or hinder their implementation and sustainability. Additionally, observations were conducted of constructed or renovated water supply, sanitation, and hygiene infrastructure in schools and healthcare facilities. This approach was selected to capture rich, detailed narratives that could not be elicited through a structured quantitative approach.

Sample size calculation for households

The Cochran formula (Cochran, 1963) for sample size calculation is recommended for large population size given a desired confidence level and the estimated proportion of the

attribute present in the population. According to 2022 national census , Mtama DC had a population of 166, 493 while that of Lindi Municipal Council was 174,126 (URT, 2022). Therefore, since this is a large population, the sample size was estimated using the following formula:

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where:

- *no* = sample size required,
- e = the desired level of precision (i.e., the margin of error),
- p = the (estimated) proportion of the population that has the attribute in question,
- q = 1 – p,
- z =1.96 (at 95% CI).

Since the known proportions of the populations in Mtama DC and Lindi MC with improved WASH were unknown, it was assumed that 50% of the population had improved WASH. This estimation of the proportion (p =50%) for a population of unknown characteristics of interest was used to maximise the variance and produce the maximum sample size.

Therefore,

p = 0.5

z= 1.96

q=1-05=0.5

e=0.05

$\boldsymbol{n}_o = ((1.96)^2 * (0.5) * (0.5)) / (0.05)^2 = 385$

This yields a random sample of 385 households in Mtama DC and Lindi MC, with a sample size large enough to achieve the required confidence level. Because the populations of the two districts were nearly equal, each district contributed half of the study population.

Sampling school children

According to data from Mtama District Council and Lindi Municipal Council, there were 117 primary schools across the two districts. Given that the total number of schools was fewer than 1,000, a sample size equivalent to 10% of the population was considered appropriate, yielding a sample of 12 schools (N = 10/100 × 117 = 11.7 ≈ 12). To ensure geographical representation and avoid clustering of selected schools in a single area, a stratified random sampling technique was employed. The schools were first stratified by district (Mtama district and Lindi Municipal) and then by wards within each district. A proportional allocation method was used to determine the number of schools to be selected from each district, based on the total number of schools in that district.

A total of 5 schools were chosen from the Mtama District Council, and 7 schools were selected from the Lindi Municipal Council. Within each stratum, schools were randomly selected using a simple random sampling method from an updated list of all schools provided by the respective district education officers. This ensured fair geographic distribution and minimized sampling bias. At the school level, 32 pupils per school were selected to participate in the evaluation. The selection of pupils was carried out using a systematic random sampling method from class attendance registers, ensuring equal representation of boys and girls where possible. In total, 384 school children were included in the study.

Sampling for health care facilities

There was a total of 49 healthcare facilities in Mtama DC and Lindi MC distributed as follows: 6 health centers, 42 dispensaries, 1 hospital. Since the total number did not exceed 1,000 then, 10% of them was sampled from each category of healthcare facility. Thus: for dispensaries (Nd): Nd=10/100*42=4.2; and for health facilities (Nhf): Nhs=10/100*6=0.6 ≈1. Thus, a total of 5 health facilities were included in the survey (5 dispensaries and 1 health center). Therefore, a total of 6 beneficiary health care facilities were selected.

Sampling for the qualitative approach

Qualitative data were collected through focus group discussions (FGDs) and key informant interviews (KIIs). Key informant interviews were conducted with district officials (DHO, DWE, and SWASH coordinators) from both Lindi MC and Mtama DC. One FGD for caregivers was conducted in each of the representative wards until the point of saturation in responses was reached. Caregivers were drawn from villages within the wards. One FGD for teachers and school committees was conducted in each ward (one school per ward). One FGD was conducted with village executive officers in each participating ward. Village leaders were randomly selected from villages within that ward. One KII was conducted at the facility in charge of the project health facilities.

Evaluation criteria of OECD/DAC

The Development Assistance Committee's definition of evaluation contains five criteria: relevance, effectiveness, efficiency, coherence, and sustainability (OECD/DAC; OECD, 1996). The scope of this evaluation did not include “impact”; however, due to the nature of the intervention, coordination was included among the evaluation criteria. The criteria relevance, coherence, effectiveness, sustainability, and coordination were evaluated by stakeholders (mostly decision makers) at Mtama DC and Lindi MC and involved District Health Officers (DHOs), District School WASH coordinators (education sector), and District Water Engineers. The evaluation criteria assessed in the project included relevance, which examined the alignment with community needs, consistency with policy goals, and stakeholder engagement. Effectiveness was measured by the achievement of objectives and improvements in beneficiary outcomes. Efficiency was evaluated in terms of resource utilisation, time management, and cost-effectiveness. Coherence was assessed with respect

to coordination with other initiatives, sector integration, and alignment with broader policies. Sustainability assessed the long-term viability of benefits, capacity building for local maintenance, and financial sustainability. Lastly, coordination was evaluated with respect to stakeholder collaboration, communication channels, and feedback mechanisms. A set of questions was designed for a qualitative approach, in which respondents, both beneficiaries and stakeholders, were asked to provide detailed insights into the criteria under consideration.

Data collection

Recruitment and training of data enumerators

Data collection was conducted by a team of trained enumerators, including two experts in qualitative research. Enumerators recruited for this study had backgrounds in the social sciences and public health. Preference was given to those with prior experience conducting field-based data collection in similar settings. Before the commencement of fieldwork, a two-day training session was conducted covering ethical considerations, data collection techniques, the use of data collection tools (structured questionnaires, interview guides, and observation checklists), and quality assurance protocols.

Data collection tools

The data collection tools, including structured questionnaires for quantitative data and semi-structured guides for key informant interviews (KIIs) and focus group discussions (FGDs), were developed in consultation with WASH experts and aligned with the study objectives. All tools were prepared in both English and Kiswahili language. A pilot test was conducted in one non-participating ward in Lindi Region. Based on the pilot results, modifications were made to improve clarity, simplify language for school-aged children, and reduce redundancy. These changes enhanced both the usability and reliability of the tools.

Quantitative data were collected using a structured questionnaire administered digitally via ODK (Open Data Kit) on tablets. Enumerators guided respondents through the tool during school visits, and responses were uploaded to a secure server daily. Data were later exported to SPSS version 25 for statistical analysis. Qualitative data were collected using semi-structured interview guides tailored for each target group including caregivers, school staff, health in-charges, and government officials). All KIIs were conducted face-to-face in a private setting to allow for in-depth discussions. With participants' consent, interviews and FGDs were audio recorded using a digital tape recorder. Each FGD comprised 8 to 10 participants, and group composition was homogeneous by respondent type (caregivers, teachers, or local leaders) to facilitate open discussion. Discussions were conducted in Kiswahili, the participants' local dialect, and lasted between 45 and 90 minutes.

Data management and analysis

Quantitative data analysis involved descriptive statistics, including frequencies and percentages to summarise demographic data, water and sanitation access, hygiene practices, and the prevalence of diarrhoea among children under five years of age. Analysis was conducted using SPSS. For qualitative data, all audio recordings were transcribed verbatim in Kiswahili and later translated into English for analysis. A second researcher reviewed transcripts to ensure accuracy and consistency. All transcripts were anonymised to maintain confidentiality. A thematic analysis was conducted manually and with software support to identify key themes aligned with the OECD/DAC evaluation criteria: relevance, coherence, effectiveness, efficiency, and sustainability. Triangulation of quantitative and qualitative data enhanced the validity of the findings.

Ethical considerations

Ethical clearance for this study was obtained from the Institutional Review Board (IRB) of the Muhimbili University of Health and Allied Sciences with reference number MUHAS-REC-10-2021-877. Data collection permits were also sought from the Lindi Regional Secretariat and respective councils (Lindi Municipal and Mtama District). Before the start of the interview, participants were provided with clear and comprehensive information about the purpose, procedures, and voluntary nature of the study, and informed consent was obtained from each adult respondent before participation. For schoolchildren, informed consent was obtained from headteachers. All engagements involving children were conducted in safe, supportive environments by trained facilitators with experience in child protection. Interviews with children were conducted either in the presence of a trusted adult or, when preferred by the child and appropriate for privacy, with ethical safeguards to ensure comfort and confidentiality. All data collected was anonymised, securely stored, and accessed only by authorised research personnel.

RESULTS

Demographic characteristics of school children

A total of 384 school children from 12 selected schools in both Mtama District Council (DC) and Lindi Municipal Council (MC) participated in the evaluation. The children were drawn from standard three through standard six, providing a diverse sample with respect to age, gender, and grade level. Regarding class distribution, the majority of participants were in the upper primary level. Specifically, 154 pupils (40.1%) were enrolled in standard six, while 124 (32.3%) were in standard five. Standard four accounted for 62 pupils (16.1%), and standard three had the fewest participants, with 44 pupils (11.5%). This distribution reflects the evaluation's focus on upper primary education.

In terms of age, the children were grouped into three categories. Participants aged 8–10 years comprised 89 participants (23.2% of the total sample). The largest age group was 11–13 years, which included 217 pupils (56.5%). These were mostly in Standards 5 and 6. The remaining 78 pupils (20.3%) were aged 14 years and above, a group likely to include students who started school late or repeated

classes, a common pattern in some rural and underserved communities. The gender distribution of the participants was nearly equal. A total of 190 boys participated, representing 49.5% of the sample, while 194 girls took part, accounting for 50.5% (Table 1).

Table 1: Demographic characteristics of school children (N=384)

Variable	Frequency	Percentage
Age group		
8 – 10 years	89	23.2
11 – 13 years	217	56.5
14 and above	78	20.3
Gender		
Male	I90	49.5
Female	194	50.5

WASH in schools

The results of the school water, sanitation, and hygiene (SWASH) clubs indicate that 80.2% of the school children who participated in the study were members of the SWASH club, while approximately 85% attended School-Led Total Sanitation (SLTS) training. With regards to the availability of water in schools, the majority of respondents (59%) reported that water was always available. Additionally, 24% indicated that water was available only sometimes, while 17% stated that it was not available at all. A significant proportion of pupils (99%) reported receiving training in proper handwashing practices.

In terms of knowledge on critical moments for handwashing, 66.4% of the students were able to identify at least four key moments out of a total of seven (7). Additionally, 98% and 96% of respondents recognised handwashing before eating and after using the toilet, respectively, as essential hygiene practices. Other moments for critical handwashing mentioned include after eating (92%), after cleaning the area (67%), and before cooking (57%). However, 66% of school children always wash their hands with running water and soap (Table 2)

Table 2: Knowledge on critical moments for handwashing among school children

Handwashing Occasion	Yes (%)	No (%)
Before eating	98	2
After eating	92	8
Before cooking	57	43
After cleaning the area	67	33
After visiting a toilet	96	4
After attending a child	44	56
After playing	34	66

A total of 91% of schoolchildren who participated in the survey correctly identified the steps for proper handwashing. They were also asked to demonstrate the handwashing process in accordance with the WHO guidelines (WHO, 2009). Participants who accurately demonstrated steps 4 to 5 were categorised as having 'good' handwashing practice, while those who demonstrated steps 6 to 7 were categorised as having 'very good' practice. The results showed that 41% of the children were classified as 'good' and 50% as 'very good' (Figure 1).

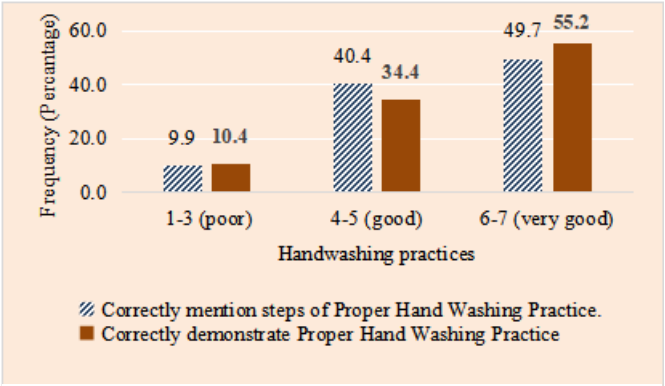

Figure 1: Steps and demonstration on handwashing practice among school children

Sanitation facilities and a diarrhea disease in the communities

In assessing household sanitation conditions, the findings revealed that 71% of households had traditional pit latrines. While these types of latrines are an improvement over open defecation, they may not provide adequate hygiene and sanitation. In contrast, only 12% of households were equipped with improved pit latrines, which are designed to reduce health risks, and merely 7% had access to pour-flush latrines. This disparity in sanitation facilities underscores the urgent need for improved infrastructure and hygiene education to improve health outcomes among young children in the community. In addition to diarrhea disease, caregivers of children under five years old were surveyed about whether their child had experienced diarrhea in the past week. The results indicated a concerning prevalence of diarrhea among children in this age group, with 9.6% reporting such episodes. This statistic underscores a significant public health issue that may be linked to the inadequate sanitation facilities observed.

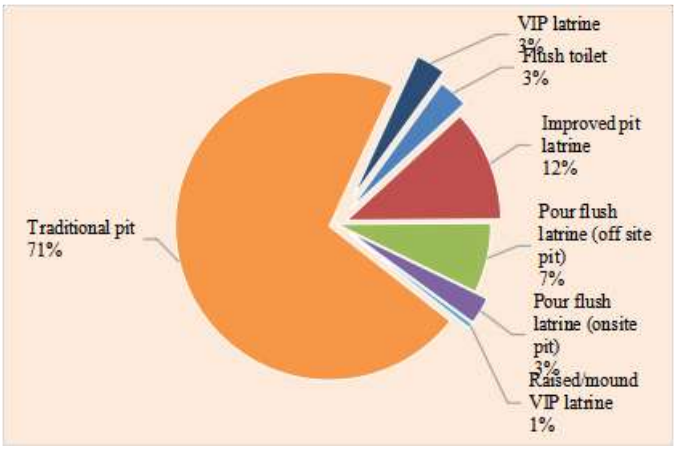

Figure 2: Type of toilet in the households

WASH in health care facilities

Observations were conducted in six selected health facilities to assess their water, sanitation and hygiene status. The results revealed that five out of six of these facilities had a water reservoir with a capacity of 2,000 litres, while the remaining one utilised water storage tanks with a capacity of 3,000 litres. Drinking water points were available in five of the health care facilities, and three of these facilities reported chlorinating their drinking water to ensure it is safe for consumption.

Further observations indicated that all health care facilities (100%) had handwashing points equipped with running water and soap. Among these handwashing stations, 60% consisted of buckets fitted with taps, facilitating easy access for staff and patients. It was noted that 67% of the soap used was commercial detergent, whereas the remaining 33% was powdered soap reconstituted for use.

Regarding sanitation, all six health care facilities were equipped with improved toilet facilities, reflecting a commitment to maintaining hygiene and sanitation standards. These findings underscore the importance of adequate water and sanitation infrastructure in health care settings to promote health and prevent disease transmission.

Findings of OECD/DAC evaluation criteria

Relevance: The evaluation demonstrated that the project made a significant contribution to the global Sustainable Development Goals (SDGs), particularly Goal 6, which aims to ensure the availability and sustainable management of water and sanitation for all. Locally, it addressed the National Sanitation Campaign (NSC) in the Lindi region, where uptake had been notably low. Before the project, schools and dispensaries faced severe shortages of toilets and water access. Post-implementation, as one of the participants in Matama DC reported a marked reduction in these issues*: "Before the project, there were inadequate toilets... but now the problem has been solved" (KII01; Mtama DC).*

Additionally, community health education initiatives were integrated into the project. For example, local leaders noted improvements in hygiene practices among community members, leading to enhanced health outcomes: *"Hygiene in the dispensaries has improved, and women now have access to water during delivery" (KII04; Ruo village).*

Coherence: The project exhibited strong internal coherence, aligning with both local interventions and broader governmental strategies. The targeted implementation successfully reached all areas lacking WASH services. As one health committee member noted*, "The project targeted areas lacking WASH interventions, ensuring no duplication of efforts. It was implemented in regions without any existing WASH services" (KII02; Lindi MC).*

External coherence was also evident, as the project supplemented the efforts of other partners, such as SONGAS, which constructed latrines at local schools. In contrast, the WASH project focused on water supply and hygiene education.

Effectiveness: The project led to substantial improvements in WASH conditions and practices, with a reported 75% improvement in sanitation behaviors across schools, as indicated by the survey results. This significant enhancement reflects the project's focus on providing adequate facilities and promoting hygiene education. A local education officer emphasized the positive changes, stating*, "Toilets are now clean; school children are flushing the toilets because there is water" (KII03; Kiwalala ward).*

This observation underscores the importance of a reliable water supply in promoting good sanitation practices among students. Additionally, caregivers reported a notable decline in waterborne disease incidence in the community. One participant shared, *"Our knowledge on preventing waterborne diseases has improved, leading to a decrease in diarrheal diseases" (KII06; caregiver, Mtama DC).* This indicates that not only have conditions improved, but the project has also successfully educated the community on hygiene practices, further contributing to better health outcomes.

Efficiency: Resource allocation and management were executed efficiently, maximising community involvement throughout the project. The cost-effective strategies employed in the two municipalities of Mtama and Lindi demonstrated a thoughtful allocation of funds for WASH services, particularly the construction of sanitation facilities. Community participation proved vital during the construction of WASH facilities, such as toilets. For instance, one participant noted that funds were primarily allocated for training and materials, while community involvement significantly reduced overall costs: *"Community members assisted in many manual activities during construction" (KII01; Mtama DC).*

This collaborative approach not only lowered expenses but also fostered a sense of ownership among community members, encouraging them to take pride in the facilities being built. The emphasis on community engagement not only enhanced the project's efficiency but also strengthened social ties, ensuring that local residents felt invested in maintaining the infrastructure. By using local resources and capabilities, the project effectively maximized its impact. This collaborative effort between caregivers and schools underscores a shared responsibility for sustaining WASH improvements, strengthening positive effects on community health and hygiene practices. Through the active engagement of caregivers and educational institutions, the project established a strong foundation for continued maintenance and education, ultimately fostering a healthier environment for all.

Sustainability: Caregivers expressed readiness to maintain the project's impact. One beneficiary emphasized their dedication, stating, *"After ensuring neighbors understand and practice hygiene well, we will continue to provide education to more people. We will keep educating others without getting tired,*

and if some people ignore it, we should not give up on making them understand hygiene" (Women FGD-Majengo ward).

This determination reflects a proactive approach to community health and hygiene, fostering a culture of continuous learning and support. Additionally, Schools are also poised to play a vital role in the sustainability of WASH initiatives. Findings suggest that they will maintain strong relationships with local community members to protect the newly built infrastructure and ensure preventive maintenance. One head teacher articulated this commitment, saying, "*In our school, we will be selling water to generate funds for project operations, including paying bills like electricity and maintenance charges. We will also allocate a budget for operation and maintenance" (KII 07 Head teacher, Mtama DC)*.

This collaborative effort between caregivers and schools highlights a shared responsibility for sustaining WASH improvements, reinforcing the project's impact on community health and hygiene practices.

DISCUSSION

Level of handwashing knowledge and practices among primary school students

The evaluation indicates that the project successfully met its objectives related to improving handwashing knowledge and practices among primary school students. Evidence from several studies highlights that effective handwashing can significantly reduce the incidence of diarrhea, acute respiratory infections, and skin infections (Belay, 2018). In this study, over half of the primary school children (66.4%) demonstrated sufficient knowledge of proper handwashing practices. This result aligns with findings from Southern and Eastern Ethiopia, where adequate knowledge levels were reported at 62.7% and 61.6%, respectively (Eshetu et al., 2020; Girma et al., 2024; Manetu & Karanja, 2021). However, it is worth noting that knowledge levels were lower compared to a study in Saudi Arabia, where 82% of children exhibited sufficient awareness (Almoslem et al., 2021). Such variations can be attributed to differences in socioeconomic conditions, participant numbers, and the effectiveness of awareness campaigns across settings.

Moreover, the study revealed that 66% of children reported washing their hands with running water and soap, significantly higher than findings from studies in Angola, Ethiopia (36.2%), and Ghana (32%) (Dajaan et al., 2018; Vivas et al., 2010) . The greater compliance observed in this study can be explained by improved access to water and soap, as well as enhanced awareness regarding the importance of hand hygiene. Notably, 98% and 96% of students reported washing their hands before eating and after using the toilet, respectively, highlighting critical moments that promote hygiene (Gawai et al., 2016). These findings support the project's objective of enhancing hygiene practices through membership in school water, sanitation, and hygiene (WASH) clubs, as demonstrated by the positive correlation between club membership and adherence to proper handwashing practices (Mengistu et al., 2022).

Coverage of water supply and sanitation facilities in primary schools

The evaluation shows significant progress in the coverage of water supply and sanitation facilities in primary schools, meeting the project's objectives in this area. Approximately 59% of students reported consistent access to water at their schools, with 62.4% reporting that water was always available. While this figure is lower than the 78.26% reported in the Niger Delta (Kalyani et al., 2017), it still reflects an improvement in basic drinking water access. The project achieved an 88% coverage rate of basic drinking water facilities, exceeding the global average of 71% reported by WHO/UNICEF (2022). This success can be attributed to the project's focus on infrastructure development and community engagement, which fostered a sense of ownership and responsibility among local stakeholders.

Caregiver's level of handwashing knowledge and practices

The study findings revealed that 261 out of 385 caregivers (67.8%) had adequate knowledge of hand washing. This was much higher than that of the study conducted in Northwest Ethiopia, where 52.2% of mothers of children under 5 years reported having adequate handwashing knowledge (Henok et al., 2019). The five moments considered as critical times to wash hands include after defecation, after handling child/adult feces or cleaning a child's bottom, after cleaning the environment, before preparing food, and before eating food (Wana, 2023). In the current study, a higher proportion of the respondents reported washing their hands at critical times. 90% and 98% of the caregivers reported washing their hands after visiting the toilet and before eating, respectively. The finding revealed by this study was higher than a study conducted in Addis Ababa, Ethiopia, where 74.4% of caregivers reported washing hands at critical times (Ermias et al., 2023). This variation could possibly be due to the availability of water, differences in the level of knowledge on the importance of hand washing at critical times among caregivers or mothers of children under five years of age.

Magnitude of diarrhoeal diseases among children under-5 years of age

Diarrheal diseases are known to be significant contributors of morbidity and mortality in the world caused by unsafe water, poor sanitation and hygiene. Approximately 1.6 million deaths occur each year globally due to diarrhea with the highest burden occurring in developing countries and economically disadvantaged region (Wolde et al., 2022). Of all child deaths from diarrhoea, 78% of child deaths from diarrhoea are reported to occur in the African and Southeast Asian regions (Farthing et al., 2013). Diarrhoea can be easily prevented through the provision of safe drinking water and good sanitation.

The findings of the present study revealed that during the one week preceding the day of the survey, the prevalence of diarrhoea among children under five years of age was 9.6%. The findings are consistent with the study conducted in South

East Nigeria, with the prevalence of childhood diarrhoea reported to be around 10.77% (Nwokoro et al., 2020). These findings are much better than those reported in a study conducted in India, with 21.6% of the caregivers reporting that their children were suffering from diarrhoea in the last two weeks preceding the day of the survey (Giri et al., 2022). Also, in a cross-sectional study that was conducted in Uganda, about 29.1% of the children under 5 years were reported to suffer from diarrhoea during the two weeks preceding the survey (Omona et al., 2020).

The low prevalence rate of diarrhoeal disease among children under five years of age observed in this study may be due to increase in households' access to improved water sources which has been constructed by project, increased awareness on hygienic practices among caregivers such as handwashing with running water and soap during critical moments and through provision of health education to caregivers during reproductive child health (RCH) clinic visits.

Several studies have indicated there is a significant association between drinking water sources and diarrhoea diseases among children below five years of age (OECD/DAC, 2016). A study conducted in Uganda also showed that the risk of developing diarrhoea in children whose households use protected water sources was 68% lower compared to their counterparts who use unprotected water sources (Omona et al., 2020). Conversely, a study conducted in Kenya revealed that households using unprotected water points such as wells had a higher likelihood of reporting childhood diarrhoea cases (17.69%) (Samwel et al., 2014).

IMPLICATION OF THE STUDY

The evaluation demonstrates that WASH interventions can substantially reduce diarrhoeal disease among children under five when infrastructure, behaviour change, and local governance are addressed together. By documenting improvements in safe water access, sanitation facilities, and handwashing knowledge in schools, health facilities, and households, the findings provide evidence to justify continued and scaled-up WASH investments in similar Tanzanian settings. The use of OECD/DAC criteria also demonstrates that structured evaluations can guide decision-makers in assessing relevance, effectiveness, efficiency, coherence, coordination, and sustainability, thereby informing future program design and resource allocation.

CONCLUSION

The WASH project achieved the set target of construction and improvement of WASH infrastructure and services, provided training to school children, and caregivers of children under five years of age, which led to the reduction of the prevalence of diarrhoea. Basic drinking water coverage in target primary schools and health care facilities increased, and they are getting a water supply throughout the year. With regard to the OECD/DAC evaluation criteria, all were met with respect to relevance, effectiveness, efficiency, coordination, coherence, and sustainability. The evaluation recommends that the Lindi region, particularly Mtama DC and Lindi MC, ensure to sustain the achievements made through collective responsibilities of all stakeholders at all levels.

STUDY LIMITATIONS

This evaluation study has several limitations that should be acknowledged. First, while the quantitative data collection relied on self-reported measures from school children and caregivers, such responses may be subject to biases, including social desirability bias, where respondents might overreport positive hygiene behaviors. Second, the qualitative component, although rich in insights, was limited in scope, focusing on specific regions and potentially overlooking perspectives from other areas within Lindi Region. Additionally, the study's cross-sectional design does not permit establishing causal relationships between the WASH interventions and observed outcomes, such as reductions in diarrheal diseases.

Finally, the reliance on convenience sampling for selecting schools and healthcare facilities may limit the generalizability of the findings to all schools and healthcare facilities within the region. Despite these limitations, the study provides valuable insights into the impact of WASH interventions on health outcomes in the Lindi Region.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest.

AUTHORS' CONTRIBUTIONS

HM conceived the study, designed the data collection tools, drafted the manuscript, and finalized it. HJM reviewed the manuscript. All authors read and approved the final version of the manuscript for submission.

DATA AVAILABILITY

The data supporting this study's findings cannot be shared publicly but will be available upon request of a researcher(s).

LIST OF ABBREVIATIONS

WASH – Water, Sanitation, and Hygiene
OECD/DAC – Organisation for Economic Co-operation and Development / Development Assistance Committee
WHO – World Health Organization
TDHS – Tanzania Demographic and Health Survey
DC – District Council
MC – Municipal Council
SLTS – School-Led Total Sanitation
IEC – Information, Education, and Communication

FGD – Focus Group Discussion
KII – Key Informant Interview
IRB – Institutional Review Board
RCH – Reproductive and Child Health
SWASH – School Water, Sanitation, and Hygiene
SDGs – Sustainable Development Goals

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