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WASH Barriers to Neglected Tropical Disease Prevention Practices in Primary Schools: A Case Study of Bunyala Sub-County, Kenya

WASH Barriers to Neglected Tropical Disease Prevention Practices in Primary Schools: A Case Study of Bunyala Sub-County, Kenya

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Abstract
Neglected tropical diseases targeted for management and eradication by the year 2030 depend heavily on water, sanitation, and hygiene. Clean water and hygienic conditions are crucial in reducing exposure to diseases; while sanitation is crucial in management of various Neglected Tropical Diseases (NTDs). This is particularly vital in schools, where children are often highly vulnerable to infection, and where good hygiene practices are taught and reinforced. Despite the Kenya School Health Policy and the Constitution of Kenya aiming at reducing Water, Sanitation and Hygiene (WASH)-related diseases and ensuring access to clean water and adequate sanitation in schools, there has been a reported increase in the prevalence of these diseases, including NTDs. The study was conducted in Bunyala Sub-County, using a cross-sectional study design. It employed a purposive sampling method to select 2 wards out of the 4 wards in the sub-county; and 2 primary schools per the selected wards. Data was collected using observation checklists. Three major themes emerged through a critical thematic analysis of the school profiles and sanitation facilities: inadequacy of sanitation facilities, gender disparity in infrastructure, and gaps in inclusion of special needs and hygiene. The study concluded that the physical environment in schools poses a severe threat to the health education interventions intended to improve pupils' practices on NTD prevention; and recommended expansion of infrastructure to cater for the large population, construct integrated WASH blocks, and address systemic environmental risks.

Introduction
Neglected Tropical Diseases (NTDs) are a group of parasitic, bacterial and viral infectious diseases that affect the world's poorest and most vulnerable population (Semahegn et al., 2023). All NTDs targeted for increased management and eradication by the year 2030 depend heavily on water, sanitation, and hygiene (WASH). Clean water and hygienic conditions are crucial for reducing exposure to diseases such as Schistosomiasis (SCH) and Soil-Transmitted Helminths (STH) (WHO, 2023), and sanitation is also crucial in the management of various NTDs.

The Kenya School Health Policy (KSHP) acknowledges improvement of learners' health as key to the Kenya Vision 2030 realisation, pointing out that every child has a right to access safe and clean

drinking water and adequate sanitation, complemented by appropriate hygiene promotion and education (MoH & MoE, 2018). The Constitution of Kenya guarantees learners the highest attainable health standards of sanitation and adequate quantities of clean and safe water (GoK, 2010). Despite the KSHP and the Constitution of Kenya aiming at reducing WASH-related diseases and ensuring access to clean water and adequate sanitation in schools, there has been a reported increase in the prevalence of WASH-related diseases, including Neglected Tropical Diseases (NTDs), among school-aged children (Ochola et al., 2021; Okoyo et al., 2023). This is a critical issue as NTDs are indicators of extreme poverty and inequity; they lead to severe health consequences such as malnutrition, cognitive impairment, stunted growth, physical disability, and significant school absenteeism (Okoyo et al., 2023; Ochola et al., 2021), thereby hindering learning capabilities (Rees et al., 2019). In addition, this can hinder the achievement of Kenya Vision 2030.

A study by African Medical and Research Foundation (AMREF) revealed that about 500 million people had no access to safe drinking water; 2.6 billion people lacked access to basic sanitation services, and 892 million practised open defecation worldwide, which contributed to about 10% of the annual global disease burden (Amref Health Africa, 2020). These statistics underscore a fundamental failure in equitable resource distribution and public health infrastructure on a massive scale and imply that a significant portion of the world's population remains highly vulnerable to water-borne diseases, preventable infections, and compromised dignity, perpetuating cycles of poverty and ill-health. It was further estimated that about $73 billion was lost every year due to poor WASH services in Sub-Saharan Africa (Amref Health Africa, 2020). This implies that inadequate WASH is a significant drag on economic development, actively hindering GDP growth, reducing productivity, and diverting national resources that could otherwise be invested in other critical sectors. It was further reported that, in Kenya, only 41% and 32% of the urban and rural population, respectively, had access to improved WASH services (Amref Health Africa, 2020).

Improved toilet facilities are a key indicator of NTD prevention, although facility cleanliness is very important, as it determines the likelihood of use and can foster disease (USAID, 2018; Hürlimann et al., 2018). Unclean facilities are not only unpleasant, thus deterring consistent use by the populations they are meant to serve, but they can also paradoxically become breeding grounds for pathogens (Jasper & Bartram 2025), potentially exacerbating disease transmission rather than prevention. A WASH campaign that focuses on behavioural and knowledge improvements should emphasise the implementation of WASH infrastructure (USAID, 2018; Hürlimann et al., 2018).

Soil-transmitted helminthiasis (STH), including ascariasis, trichuriasis, and hookworm infection, is directly linked to poor sanitation and hygiene, facilitating the faecal-oral transmission of infective eggs and larvae (Agrawal et al., 2024). Similarly, trachoma, the leading cause of infectious blindness globally, is exacerbated by poor facial hygiene and limited access to clean water (Emerson et al., 2019). Schistosomiasis, a parasitic disease transmitted through contact with freshwater contaminated with parasite larvae, is directly influenced by access to safe water sources and sanitation facilities that prevent water contamination (Standley et al., 2020). Furthermore, hygiene-related NTDs like scabies and tungiasis thrive in settings with poor hygiene practices and overcrowding (Feldmeier et al., 2020). Many communities lack access to conveniently located and safe water sources, forcing reliance on contaminated surface water or requiring long and arduous journeys to fetch water (Bain et al., 2014). Children, often responsible for water collection, are particularly vulnerable to water-borne pathogens and have less time for education and play (Cronk & Bartram, 2018). Insufficient or absent sanitation infrastructure leads to open defecation, contaminating the environment and increasing the risk of faecal-oral transmission of NTDs (Graham et al., 2016).

Environmental conditions, such as water scarcity, flooding, and drought, can severely impact WASH infrastructure and hygiene practices (Wilkinson et al., 2019). Climate change is expected to exacerbate these challenges, further straining already limited resources and increasing the risk of WASH-related diseases, including NTDs (Moore, 2022). Inadequate WASH infrastructure remains a significant impediment to the prevention and control of NTDs among children. Barriers related to access, infrastructure, hygiene behaviours, socio-economic factors, environmental conditions, cultural norms, and institutional weaknesses create a complex web of challenges.

Despite KSHP and the Constitution of Kenya aiming at reducing WASH-related diseases and ensuring access to clean water and adequate sanitation in schools, there has been a reported increase in the prevalence of WASH-related diseases, including NTDs, among school-aged children (Okoyo *et al.*, 2023; Ochola *et al.*, 2021). While these policies mandate children's rights to adequate WASH, they lack operational frameworks to translate policy into sustainable pupils' behaviours.

The study aimed at evaluating the institutional WASH barriers that hinder effective prevention practices for NTDs within primary schools in Bunyala Sub-County. The objective of the study was to map the availability, adequacy, accessibility, and functionality of existing WASH infrastructure in these schools, with the aim of providing evidence-based recommendations to local health authorities and education policymakers to design targeted, climate-resilient WASH infrastructure that fosters safer learning environments and accelerates NTD elimination goals.

Methods

The study was conducted in Bunyala Sub-County, located in the lower region of Busia County, Western Kenya, and serves as a critical socio-ecological study site due to its unique geographical positioning and environmental challenges. The region is defined by its proximity to large bodies of water and a high water table. Despite recent improvements, many schools face challenges with seasonal flooding, which often destroys pit latrines and contaminates shallow wells. The researchers considered a cross-sectional study design to carry out the study. This was due to the fact that the study was purely observational and did not involve manipulating study variables.

Bunyala sub-county has 4 Wards: Bunyala North, Bunyala South, Bunyala Central and Bunyala West. The study employed a purposive sampling method to select 2 Wards out of the 4 Wards in the sub-county, as well as 4 primary schools, 2 per selected Ward. The selection of wards and schools was based on those affected by the Yala Swamp and the flooding of the River Nzoia. This targeted selection guarantees that the final case study captures the most critical, actionable barriers facing NTD elimination within the sub-county's primary schools.

The study excluded private schools and boarding schools since they operate under different socio-economic, administrative, and environmental conditions, which would introduce confounding variables on resource availability and student exposure risks. The researchers used observation checklists to collect data on school WASH infrastructure to ascertain the availability, adequacy, accessibility and functionality per gender. For the pit latrines, the researchers were interested in knowing the type of latrine floor, type of walls, roofing material, number with door for privacy and separation by gender. In addition, the researchers were interested in whether there were separate latrines for pupils and teachers, and in the location of sanitary facilities relative to water sources. For the handwashing facilities, the researchers were interested in the status, availability, and location of handwashing stations relative to sanitary facilities and their adequacy by gender at the time of observation. In addition, the researchers were interested in observing the general cleanliness of the classrooms and the school compound, as well as solid waste management.

Data were analysed using thematic analysis to generate recurring themes, patterns, and meanings related to the observed phenomena (Braun & Clarke, 2022). This involved familiarisation, coding, searching for themes, and reviewing the themes. Defining and naming the theme, and finally presenting the themes with supporting examples from the observational notes. The researchers generated codes using both inductive and deductive coding. The inductive coding emerged directly from the data collected by identifying patterns that were not preconceived. Deductive coding was informed by the theoretical framework grounded in Social Cognitive Theory (SCT). This theory conceptualises the adoption of health behaviours through Triadic Reciprocal Determinism, a continuous, interactive loop among environmental factors, personal factors, and behavioural outcomes. Environmental factors represent the physical and institutional WASH barriers within primary schools in the sub-county. According to SCT, these structural constraints directly restrict behavioural outcomes, which comprise NTD prevention practices among the pupils. This environmental-behavioural pathway is mediated by personal factors, such as knowledge of NTD and individual perceived self-efficacy (Bandura, 1986, 2004). In structurally deficient school environments, a pupil may possess high health literacy (a personal factor), yet the absence of water and soap (an environmental factor) diminishes their self-efficacy, ultimately resulting in a failure to perform protective actions (a behavioural factor) and driving up NTD reinfection rates (Ochola et al., 2021; Okoyo et al., 2023).

In addition, thematic analysis allowed the researchers to delve deeply into the pupils' perspectives to understand the nuances of the barriers they face, yielding a set of themes that represent the key WASH-related barriers to adopting NTD prevention practices, thereby answering the research objective.

Ethical Considerations

The researchers sought clearance from the Masinde Muliro University of Science and Technology School of Postgraduate Studies (SGS) and the Institutional Ethics and Research Committee (IERC). Thereafter, the researchers applied for a Research Licence from NACOSTI and cleared with the Busia County Commissioner's office, County Education Office, Sub-County Education Office, and school head teachers before carrying out the study. The researchers adhered to the principles of research ethics (Respect for Persons, Beneficence and Non-Maleficence, Justice) throughout the study. Privacy protocols were enforced during observation of the WASH infrastructure. Observation was scheduled during class periods to prevent any physical or visual intrusion of pupils utilising the facilities, thereby preserving individual privacy and dignity. Documentation of the observed structural vulnerabilities and deficits in the WASH infrastructure was conducted anonymously. No school names were attached to any data sheets. The observation checklists were converted into codes to protect institutions from punitive exposure. The observational criteria were applied equitably and transparently across all the selected schools without bias.

Results

The assessment of WASH infrastructure across the four primary schools in Bunyala Sub-County revealed critical insights into the environment where pupils are expected to practice disease prevention. Three major themes emerged through a critical thematic analysis of the school profiles and sanitation facilities. These were: inadequacy of sanitation facilities, gender disparity in infrastructure, and gaps in inclusion of special needs and hygiene.

Inadequacy of sanitation facilities and high pupil-to-latrine ratios was a significant theme identified across all schools due to a severe shortage of latrines relative to the high pupil populations. For instance, at 'A' primary school, with a population of 840 pupils (435 male and 405 female), there

were 7 functional latrines, where 4 were meant for female pupils while 3 were for male pupils, giving a ratio that far exceeded the national sanitation standards. This pressure on infrastructure is further exacerbated by operational failures; at 'D' primary school, where 6 toilets were not in use due to a lack of water. This indicated that even where physical structures existed, the lack of supporting utilities (water) rendered them obsolete, potentially forcing pupils to resort to risky alternatives such as open defecation or the shared use of overcongested pits.

Gender disparity in infrastructure allocation was inconsistent. For instance, at 'C' primary school, there was a clear prioritisation of female pupils, where 10 latrines were provided for 377 girls as compared to only 3 latrines for 232 boys. Conversely, at 'D' primary school, 376 girls had access to only 3 functional pit latrines, while the 200 boys had access to 7 pit latrines. These disparities suggest that infrastructure development was not based on a standardised per-capita requirement for both genders, which can lead to long wait times, particularly affecting girls' school attendance during menstruation.

While there were positive indicators of inclusivity, such as the provision of latrines for Persons with Disabilities (PWDs) in some primary schools ('B' and 'C'), this was not a universal standard across the sub-county. Furthermore, the provision of bathrooms, which are essential for Menstrual Hygiene Management (MHM), was low, with only 2 primary schools ('B' and 'D') having a single bathroom each. The absence of private bathing facilities at some primary schools ('A' and 'C') presented a significant barrier to the dignity and hygiene of adolescent girls, directly impacting their ability to manage WASH-related health needs effectively during school hours.

Further observation of the schools' WASH facilities revealed that the physical infrastructure of the latrines across the selected schools was made of permanent construction. The latrines had cemented floors, brick walls, and iron sheet roofing, indicating a commitment to ensure durability and weather resistance. All the latrines had functional doors, thus ensuring user privacy. Furthermore, a clear separation of latrines for the boys and girls was observed, which was an essential requirement for dignity and safety within the school environment. There was provision of latrines for teachers, which suggested a hierarchical separation of facilities intended to maintain professional boundaries and ensure sanitary standards for teachers.

Although the latrines were built using permanent materials (bricks and cement), a closer analysis of the observation revealed significant structural deterioration. Some of the walls were recorded to have visible cracks, suggesting either poor construction quality or a lack of timely repairs. Furthermore, while the floors were cemented, most were rough and had potholes, compounded by poor drainage, leading to the accumulation of stagnant water and/or urine on the latrine floors. This combination of rough floor surfaces and potholes creates significant hygiene risks, as these areas act as reservoirs for bacteria and foul odours, making the floors difficult to clean effectively.

The observation revealed a deficit in both the quantity and functionality of handwashing infrastructure. The provision of handwashing stations across the selected schools was minimal and non-standardised. Most schools had only two handwashing stations, with only one school having three. It was further noted that the handwashing facilities were donated items from the COVID-19 pandemic era, rather than permanent, integrated school infrastructure. At the time of inspection of these facilities, a functionality gap was observed as there was no soap at all handwashing stations; several stations had no water, rendering them unusable for hygiene purposes. There was no gender segregation for handwashing; the stations were placed in communal areas with no separate facilities

for boys and girls, and were located some distance from the pit latrines, making it difficult for pupils to wash their hands immediately after using the pit latrines.

The majority of the classrooms were untidy, with potholed cement floors and dust; although a few classrooms had tiled floors, they were dusty due to the hot, dry weather at the time of inspection. The school compounds were fairly well maintained, with a few cases of littering and shrubs observed around the pit latrine areas. The shrubs around the sanitary areas could pose risks of possible snake bites. The schools had designated areas for solid waste disposal, though they appeared littered by the wind. Among the schools that were selected, only one school ('A' primary school) had a source of water which was a shallow well, located less than 10 metres from the pit latrines. Based on the observation and the soil type, it is clear that the water from the shallow well was not safe for human consumption. The majority of the schools depended on communal water sources located in the neighbourhood. In addition, the schools harvested rainwater for use at the schools, but this was unreliable. Not all handwashing points were gender-segregated, and at the time of inspection, all handwashing stations had no soap. Table 1 shows the results:

Table 1: Provision of WASH Facilities in Primary Schools

	Enrolment			**Sanitary Facilities**			**Hygiene Facilities**	
School	**Total**	**Male**	**Female**	**Male**	**Female**	**PWDs**	**MHM**	**Hand wash**
A	840	435	405	3 and 1 urinal	4	None	None	3
B	755	373	382	6	5	1 by gender	1 Bathroom	2
C	609	232	377	3	10	1 by gender	None	2
D	576	200	376	7	3	None	1 Bathroom	2

Discussion

The findings suggest that the physical environment in Bunyala sub-county primary schools may undermine the prevention and control of NTDs. The high pupil-to-latrine ratios observed in 'A' primary school represent a systemic failure to meet the WHO recommendation of 1:30 for boys and 1:25 for girls (WHO, 2023). The water scarcity observed at 'D' primary school, where toilets were not in use, highlights a critical knowledge-action gap. Pupils may know that washing hands and using latrines/toilets prevent WASH-related NTDs, but they are physically unable to perform the behaviours since the infrastructure is non-functional due to a lack of water. This environmental constraint is a known driver of NTDs in Western Kenya, as it sustains the transmission cycle despite educational efforts (Omedo et al., 2020). Furthermore, the lack of MHM facilities (bathrooms) in 50% of the surveyed schools is a major concern. Adequate WASH in schools is not just about disease prevention; it is about gender equity. The absence of bathrooms makes it difficult for girls to remain in school during their cycles, often leading to absenteeism (Zulaika et al., 2022).

In addition, the findings revealed that all the selected schools had permanent latrine structures with cemented floors, brick walls, and iron roofing, indicating that these institutions had met the physical requirements for basic sanitation services. Basic sanitation in schools is defined not just by the presence of a facility, but by its usability and the use of improved materials that prevent contact with waste (UNICEF and WHO, 2024). Literature highlights that durable, non-porous materials like cement are essential for climate resilience; permanent infrastructure is significantly more likely to withstand extreme weather events compared to traditional mud-and-thatch structures (WHO, 2025). These findings are also consistent with findings of a study that argued that permanent construction is essential for maintaining hygiene, as non-porous surfaces like cement are easier to clean and disinfect than traditional mud or earth floors (Anderson, 2025). Furthermore, the findings revealed

that all the latrines had functional doors, which is a critical finding on user dignity. These findings support the reported lack of lockable doors as a primary barrier to school sanitation use, especially for menstruating girls who require a secure and private environment (Poague et al., 2022), since menarche occurs between 10 and 15 years (Korir et al., 2018).

Finally, the strict gender segregation of facilities for boys, girls, and teachers reflected a modern understanding of gender equity in education. Recent systematic reviews confirmed that gender-segregated toilets can add up to 1.34 years to a girl's potential schooling in rural areas. This spatial demarcation is particularly vital for Menstrual Health and Hygiene (MHH) (Sharma et al., 2022). The presence of separate, private facilities is a prerequisite for girls to manage their cycles without fear of harassment or embarrassment, directly influencing school retention rates (UNICEF Indonesia, 2024). Thus, the observed infrastructure is not merely a logistical success but a strategic tool for promoting gender parity in education. However, while the physical structures are adequate, literature suggests that the mere presence of latrines does not guarantee long-term hygiene; without a dedicated maintenance and cleaning budget, the permanent structures can still become health hazards (McMichael, 2019).

The findings further indicated a significant gap between the provision of sanitation infrastructure and its functional sustainability. While the schools utilise permanent materials such as bricks and cement to construct pit latrines, which aligns with WHO standards for durable WASH infrastructure (WHO, 2025), the presence of cracked walls and potholed floors suggests a maintenance gap. Recent studies by UNICEF argue that the infrastructure-only approach often fails because it neglects the lifecycle costs of repairs (UNICEF & WHO, 2024). The observed rough floors and poor drainage raise public health concerns. Floors that are not smooth and not self-draining become primary vectors for the transmission of STH and other water-borne pathogens (Benjamin-Chung et al., 2021).

Furthermore, it was noted that deteriorating aesthetics, such as cracked walls and stagnant water, significantly decrease pupils' willingness to use pit latrines, often driving pupils toward open defecation despite the presence of a physical building (Toilet Board Coalition, 2024). These findings suggest that the schools are currently in a state where the shell of the facility exists, but the internal conditions compromise the health and dignity of the users. This supports the argument that Sustainable Development Goal 6 (SDG 6) cannot be achieved through construction alone; it requires a systematic Operations and Maintenance (O&M) framework to prevent permanent structures from becoming hazardous environments (McMichael, 2019).

The results indicated that although the schools possessed the physical handwashing station for hand hygiene, they were experiencing a total failure in the provision of water and soap. The reliance on COVID-19 era donations suggests that handwashing has been treated as a temporary emergency response rather than a permanent institutional priority. Pandemic-driven WASH interventions often suffer from post-crisis neglect, where facilities fall into disrepair once external monitoring and funding cease (UNICEF & WHO, 2024). The absence of soap and water during the inspection is a critical finding. The World Health Organisation emphasises that a handwashing station without soap is considered limited rather than basic (WHO, 2025). The lack of consumables suggests a breakdown in the school's operational budget or a lack of administrative oversight; supported by a study that reported that the mere presence of a sink does not improve health outcomes; it is the consistent availability of soap that reduces diarrheal and respiratory diseases by up to 40% in school settings (Jasper et al., 2012). Furthermore, the lack of gender-separated handwashing stations presents a barrier to inclusive hygiene. Modern WASH standards advocate for gender-specific hygiene areas, especially to support Menstrual Health and Hygiene (MHH). Adolescent girls often

avoid communal handwashing stations if they are located in highly visible, non-private areas while they are managing their periods (McMichael, 2019). The current communal setup, while space-efficient, may inadvertently discourage female students from maintaining proper hygiene during their menstrual cycles.

The Social Cognitive Theory's principle of Triadic Reciprocal Determinism suggests that behaviour is not just a choice; it is influenced by the interaction between the individual, their behaviour, and their environment. From the observation, there are gaps in facilities, particularly for PWDs and MHM. If the environment does not support the adoption of a behaviour, the student's behavioural capability is diminished. Even if a student has the knowledge (Personal factor), the lack of a physical environment (Environmental factor) prevents the execution of the health behaviour. When the ratio of students to facilities is high, a barrier to action exists. This lowers a student's self-efficacy regarding the behaviour, thus leading to a drop in the desired behaviour (Bandura, 2004). Individuals are motivated by the expected consequences of their actions; for female students, the outcome expectation of attending school during menstruation might be negative due to a lack of privacy (Bandura, 1986). When a school provides specific facilities (provision of facilities for PWDs), it signals a social norm that hygiene and inclusivity are priorities. This facilitates observational learning, where students model their hygiene behaviours based on the institutional value placed on these facilities.

Limitation of the Study

The study adopted a cross-sectional design to collect data at a single point in time, which may be affected by seasonal variation. For this study, data were collected during the dry season. If data are collected during rainy seasons, the findings could differ, as flooding might compromise pit latrines but increase water availability.

The study was prone to the Hawthorne effect, where participants alter their behaviour simply because they know they are being observed. To mitigate this bias and capture more authentic data, the researchers conducted impromptu school visits. These unannounced observations were carried out at various times of day to enhance the consistency and reliability of the collected data.

The study was purely observational, carried out in 4 primary schools selected in 2 wards in the sub-county. This was tied to a specific time, context and environment, which makes it difficult to generalise the findings, given the small sample size.

Conclusion

The physical environment in primary schools poses a severe threat to the health education interventions intended to improve pupils' knowledge and practices on NTD prevention and control. Critical shortages of functional latrines, water scarcity, and a lack of gender-sensitive facilities undermine the ability of pupils to practice prevention and control behaviours. The school environments reveal a critical failure in the provision of WASH infrastructure, which directly undermines any theoretical knowledge regarding NTD prevention. The reliance on ageing, non-standardised COVID-19-era handwashing stations, most of which lacked water and soap, indicated that hygiene practices are currently impossible for pupils to maintain effectively. Furthermore, the proximity of shallow wells to pit latrines, the presence of dust-prone potholed classroom floors, and the lack of gender-segregated facilities create a high-risk environment for disease transmission. Without functional, permanent, and safely situated infrastructure, the pupils remain highly vulnerable to reinfection despite their increased awareness, as the physical environment does not support the necessary preventive behaviours.

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